GUIDE TO PROGRAMMING

The SR640 dual channel low-pass filter is remotely programmable via both RS-232 and GPIB interfaces. All front panel features (except offset adjustment) may be controlled and read via the computer interfaces.

Communicating with the SR640

Before using either the RS-232 or GPIB interface, the appropriate configuration switches must be set. The configuration switch is located on the rear panel and label 'SW1'. Bit 8 of the switch selects GPIB or RS-232 operation. If bit 8 is 'on', GPIB operation is selected, if it is 'off', the RS-232 interface is enabled. The other bits of the switch take their meaning depending upon whether RS-232 or GPIB operation has been selected.

When a bit is 'on', it is in the DOWN position.

GPIB:

Bit	Explanation
8	Always on for GPIB
7	not used
6	not used
5	high order bit of GPIB address
4	GPIB address (on = 1 off = 0)
3	GPIB address
2	GPIB address
1	low order bit of GPIB address

RS-232:

Bit	Explanation	
8	Always off for RS-232	
7	on = echo	off = no echo (normally off)
6	on = 8 bit word	off =7 bit word
5	on = even parity	off = odd parity
4	on = parity enabled	off = disabled
3	baud rate select	
2	baud rate select	
1	baud rate select	

Bit 3	2	1	Baud Rate
on	on	on	19200
on	on	off	9600
on	off	on	7200
on	off	off	4800
off	on	on	3600
off	on	off	2400
off	off	on	2000
off	off	off	1800

Note that the configuration switch is only read on power-up. If a setting needs to be changed, the unit must be turned off and turned on again for the change to be recognized.

Command Syntax

Communication with the SR640 is accomplished by sending and receiving strings of ASCII characters. Characters sent to the SR640 may be sent in either UPPER or lower case.

A command to the SR640 consists of 4 ASCII characters followed by an optional question mark '?' character, followed by a list of arguments separated by commas, followed by a line-feed (<lf>) character. If spaces are included in the command string, they are ignored by the SR640. The SR640 interprets the GPIB EOI message sent with the last character of a string as equivalent to a <lf> terminator. Examples of commands are:

FREQ1,23600.<lf>	set the channel 1 filter frequency to 23.6 kHz.
FREQ?2<lf>	read the channel 2 filter frequency
*CLS<lf>	clear the status byte

Multiple commands may be sent on a single line. The commands must be separated by semicolon characters. An example of a multiple command would be:

FREQ1,23.6E3;FREQ2,100<lf>

The presence of a question mark character in a command indicates that the command is a request to the SR640 to send back a value. Values returned by the SR640 are terminated with a carriage return <cr> and a linefeed <lf>. If the GPIB interface is used, the <lf> is accompanied by the EOI message.

RS-232 Echo and No Echo Operation

In order to allow the SR640 to be operated from a terminal, an echo feature has been included which causes the unit to echo back characters received over the RS-232 port. This feature is enabled by setting bit 7 of the configuration switch on. When using the unit with a computer, this feature should be disabled to prevent spurious characters from

being sent to the computer. The echo feature is not operational when the unit is being used with the GPIB interface.

Tips on Using National Instruments GPIB cards

To successfully interface the SR640 to a PC via the GPIB, the instrument, interface card, and interface driver must all be configured properly. To configure theSR640, the GPIB address must be properly set using the DIP switch on the back panel. The SR640 is shipped with the GPIB address set to 23.

Make sure that you follow all the instructions for installing the GPIB card. The National Instruments card **cannot** simply be unpacked and put into your computer. To configure the card you must first set jumpers and switches to set interrupt levels and I/O addresses. You must then run the program IBCONF to configure the DOS resident GPIB driver. Please refer to the National Instruments manuals for complete details.

Once all the hardware and software has been configured properly, try using the IBIC program supplied with the National Instruments card to send commands and receive data from the SR640. If you cannot talk to the SR640 with the IBIC program, there is no point in trying to write a program.

Although the National Instruments language contains many commands, to avoid confusion it is best to start with a few simple ones. Use IBWRT and IBRD to write and read from the SR640. After you are familiar with the simple commands you can explore other, more complex, programming commands.

COMMAND LIST

The command list of the SR640 is detailed below. Commands that may be queried have a question mark ? in parentheses (?) after the four character command mnemonic. Commands that may ONLY be queried have a ? after the mnemonic. Parameters shown in brackets {} should be omitted if the command is used as a query. Do not send () or {} as part of the command. The variable i used in many of the commands indicates which filter channel the command will operate on. This variable can only be 1 (for channel 1) or 2 (for channel 2). The variable n is an integer variable, and must be sent as an integer, i.e. no decimal points or exponents. The variable x is a real number and may be expressed in fixed or floating point format, with or without a decimal point.

FILTER COMMANDS

ACDC(?) i{,n}

The ACDC command sets the input coupling for channel i to AC (n=0) or DC (n=1).

FLTR(?) i{,n}

If n=1, the FLTR command puts the channel i filter into the signal path. If n=0, the filter is bypassed.

FREQ(?) i{,x}

The FREQ command sets the filter cutoff frequency for channel i to x. Allowed values are $1.0 \leq x \leq 99{,}900$ (Hz).

INVT(?) i{,n}

The INVT command inverts the output signal with respect to the input (n=1), or leaves it uninverted (n=0).

LOCL n

The LOCL command sets the local/remote mode of the instrument. Allowed values are:

n	mode
0	local
1	remote
2	remote with local lockout

OVLD?

The OVLD? command queries the overload status of the instrument. The result is returned as a decimal number (0-15) which represents a 4 bit binary number. The binary number is coded as follows:

bit	meaning
3 (msb)	channel 2 output overload
2	channel 2 input overload
1	channel 1 output overload
0 (lsb)	channel 1 input overload

PREG(?) i{,n}

The PREG command sets the input gain for channel i to the value specified by n. Allowed values of n are:

n	Input Gain
0	0 db
1	10 db
2	20 db
3	30 db
4	40 db
5	50 db
6	60 db

PSTG(?) i{,n}

The PSTG command sets the output gain for channel i to the value specified by n. Allowed values of n are:

n	Output Gain
0	0 db
1	10 db
2	20 db

SRCE(?) i{,n}

The SRCE command selects the input source for channel i. The permitted values for n are:

n	Input Source
0	A
1	A-B
2	B

STATUS AND INTERFACE COMMANDS

***IDN?**

The *IDN? command returns the SR640's identification string. The string format is:

Stanford Research Systems,SR640,S/N0001,v 1.01<cr><lf>

***RST**

The *RST command resets the instrument. It is equivalent to a RCL 0 command (recall default setup).

***STB? {n}**

The *STB? command queries the value of the SR640's status byte. The byte is returned as a decimal number (0-255). The *STB? n command reads the value of bit n. The range of n is 0-7. The value returned is either 0 or 1. The various bits in the status byte have the following meanings:

bit	meaning
0	READY. Indicates unit has completed all pending commands.
1	OUTPUT FULL. Indicates the unit's output queue is full.
2	EXECUTION ERROR. Indicates an illegal value was encountered while executing a command.
3	SYNTAX ERROR. Indicates the SR640 could not interpret received characters as a command.
4	OUTPUT NOT EMPTY. Indicates the SR640 has characters waiting to be sent.
5	INPUT FULL. Input queue full. The user should send commands more slowly.
6	SRQ. Indicates the unit has requested service from the GPIB controller.
7	POWER ON. Indicates the SR640 has been powered on.

Each of the bits is set when the associated condition first becomes true. The status byte is only cleared after the *STB? or *CLS command.

***CLS**

The *CLS command clears the SR640's internal status byte. This status byte is the byte returned by the SR640 when it is serial polled via the GPIB interface. It may also be queried using the *STB? command.

***SRE(?) {n}**

The *SRE command sets the service request enable byte to the value specified by n. Allowed values are 0 through 255. When a bit is set in the status byte, the byte is logically 'anded' with the service request enable byte. If the corresponding bit in the service request enable byte is set, the SR640 issues a SRQ (service request) to the GPIB controller. This command may only be used with the GPIB interface.

***RCL n**

The *RCL n command recalls the nth stored instrument settings. Allowed values for n are 0 through 9.

***SAV n**

The *SAV command saves the current instrument configuration as stored setting n. Values for n are 1 through 9.

***PSC (?) n**

The *PSC command sets the power-on status clear bit. If n=1, the service request enable byte is cleared upon power up. If n=0, the status byte and service request enable byte maintain their values when the unit is powered down. This allows the generation of a service request upon power up.

WAIT(?) n

The WAIT command sets the RS-232 transmission delay between characters. This is sometimes useful when interfacing with slower computers and terminals. The wait interval is set to about 2ms * n. Allowable values for n are $0 < n < 255$.

PROGRAMMING EXAMPLES

The following are examples of programs which communicate with the SR640 in a variety of languages over both RS232 and GPIB. In each case, the program does the same thing: Set the channel 1 pregain to 10 db, the Channel 2 postgain to 20 db, and read the value of the channel 1 cutoff frequency. Once the basics of writing to and reading from the SR640 are mastered, the task of programming is reduced to simply finding the appropriate command from the command list.

Program Example 1
IBM PC, BASIC, via RS232

In this example, the IBM PC's COM2: serial port is used to communicate with the SR640. Note that a "straight through" RS232 cable (NOT a null modem cable) should be used to connect the PC to the SR640. The SR640 should be set to operate at 9600 baud, 8 bits, no parity.

```
10'Example program for the SR640 filter using IBM BASIC over the COM2: port
20'
30'Open the COM2: port for 9600, 8 bits, no parity, ignore handshake
40 OPEN "COM2:9600,N,8,2,CS,DS,CD" AS #1
50'
60' Clear COM2 port
70 PRINT #1,"  "
80' Set channel 1 pregain and postgain
90  PRINT #1,"PREG1,1;PSTG2,2"
100 'Now read channel 1 cutoff frequency
110  PRINT #1, "FREQ?1"
120 INPUT #1, FREQ       'read answer
130 PRINT "frequency = ",FREQ
140 STOP
```

Program Example 2
IBM PC, Microsoft FORTRAN, National Instruments GPIB Card

Please refer to the "Guide to Programming" section for additional information on using the National Instruments GPIB card. The GPIB.COM driver must be configured with IBCONF before using the National Instruments cards.

```
c example program for the SR620 using Microsoft FORTRAN and National Instruments GPIB card
c compile with /FPa /AL and link with MFIBL.OBJ (supplied by National Instruments)

$storage:2

c this line must be in the source file
      common  /ibglob/ibsta,iberr,ibcnt
      integer  sr640
      character *80  string
      real*4answer
```

```
c initialize gpib card

      call  ibinit(ibsta)

c get device id for sr640

      sr640  =  ibfind('sr640 ')

c set pregain and postgain

      call  ibwrt  (sr640,'PREG1,1;PSTG2,2',15)

c now query stage 1 filter cutoff

      call  ibwrt  (sr640,'FREQ?1',6)
      call  ibrd   (sr640,string,30)
      read  (string,1000)  answer

1000    format  (bn,f14.0)

      write  (*,*)  answer
      stop
      end
```

Program Example 3
IBM PC, Microsoft C, National Instruments GPIB card

```
/* Program to test SR640 communication using National Instruments GPIB card and
Microsoft C. Compile with /AL /FPa /c and link with the CIBL.OBJ module supplied
by National Instruments  */

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>

/* function prototypes */

void main(void);

/* variables defined in CIBL module */

extern int ibsta;
extern int iberr;
extern int ibcnt;
```

```
void main (void)
{
        int  sr640;
        char  string[30];
        float answer;

        sr640 = ibinit("SR640");        /* locate device */
        if  (sr640<0)
              error();

        ibwrt  (sr640,"PREG1,1;PREG2,2",15);   /* set gain */

        ibwrt  (sr640,  "FREQ?1",6);

        /* query frequency */
        ibrd   (sr640,string,30);


        /* and get answer */

        sscanf(string,"%f",&answer);
        printf("answer  =  %f",answer);
}
```

Circuit Description

INTRODUCTION

Schematics for the SR640 series dual-channel filters are shown on the following pages. They include the following: Preamplifier, filter stage, output amplifier, optoisolated interface, microprocessor section, communications section, front panel interface, power supplies, and front panel. The preamplifer, filter stages (4/channel), output amplifer, and optoisolated interface are located on the individual filter boards (2/instrument). The microprocessor and commuinication components are located on the digital board at the rear of the instrument.

Preamplifier

The preamplifier is a low-noise fully differential amplifier with gains from 0 to 60 db. Relays K1 and K2 select the input source and coupling, while K4 switches in a X10 attenuator used at the three lowest gain settings. The Dual FET U2, along with low-noise op-amps U3 and U4 form the feedback stabilized differential pair at the heart of the premplifier. U6 and U8 provide additional amplification. The output of the preamplifier is switched by U9 to the first filter stage or directly to the output amplifier if the filter has been bypassed.

Filter Stages

Each of the four filter stages is derived from a 3 op-amp biquadratic filter with a low pass transfer function of:

$$T(s) = \frac{s^2 + \omega_z^2}{s^2 + \frac{\omega_p}{Q} s + \omega_p^2}$$

Stage paramaters for the low pass filter are:

Stg	ω_p	Q	ω_z / ω_p
1	.6347	.5493	-
2	.8060	.9507	2.0793
3	.9850	2.095	1.9653
4	1.076	7.375	2.6776

For the high pass filter, the parameters are simply related by the lowpass to highpass transformation.

Component designations for the filter stage will be refered to as UnXX where n designates the stage number. Un14A, C, and D form the actual filter section. The tuning capacitors Cn20-Cn27 are switched by relays Kn05 and Kn06 according the the decade. Fine tuning within a decade is accomplished by the 10 bit parallel resistor networks composed of Rn40 through Rn59. Switching of the resistors is done with the FET switches Qn00 through Qn19 and their associated driver diodes.

The dual 8 bit DAC Un12 and its related output op-amps along with Un13A and differential amp Un13D allow the pole frequency and Q of the circuit to be fine tuned by adjusting the values sent to the dual DAC. This is how the unit is calibrated. The magnitude of the 'fine tuning' is set by Rn60 and Rn61.

The zero frequency of the circuit is not digitally adjustable but is instead set by resistors Rn71 and Rn72. Jumpers JPn05-n07 allow the zero-forming network to be removed from the circuit in stages that do not have zeros. The single op-amp Un15 forms the output buffer for the stage.

Output Amplifier

Un16A and B select the filter output or bypassed output from the preamplifier. The 8-bit DAC U17 provides output gain adjustment. The actual output amplifier is U119 which has its gain selected by switch U21. Output

inversion is accomplished with U22 in conjunction with the switches U16C and U16D. The optional component U23 provides a high current output buffer. Dual Comparator U20 takes care of output overload detection.

Optoisolated Interface

No direct electrical connection exists between the microprocessor section and the filter boards. Control signals for the filter boards originate from the two 32 bit latched serial input shift registers U25 and U26. These shift registers are in turn controlled by the output of optoisolator U24. Optoisolator U11 provides output isolation for the overload signals which are read by the processor section. Shift register U26 is run between -15V and ground so that its open collector outputs may be pulled up to +15V. These ±15V signals control the FET switches which determine the filter stage frequencies.

Microprocessor and Communications

The microprocessor U4 is a Z80, clocked at 3.6864 MHz by U3. U6 is an 8K ROM, while U7 provides 2K of battery backed up RAM. U1 is a 64K ROM which contains the calibration information for the filter channels. The calibration ROM is mapped as I/O, requiring flip-flop U5B to switch between the normal I/O space and the calibration ROM. U9A gates the clock to the processor enabling the processor clock to be removed during quiescent operation. The clock is restored by a control signal from flip-flop U5A in response to a keyboard or communication interrupt. Communication is accomplished with the UART U15 and GPIB chip U12.

Power Supplies

Regulators U101 provides 5V power to the microprocessor and communications circuits, while regulators U102-105 provide ±15V power to the filter sections. Note that the 5V power supply is the only one referenced to the chassis ground. Note also that each filter power supply is taken from a separate transformer secondary for maximum isolation.

Note: The SR645 and SR650 units contain additional regulators (U27 and U28) on the high-pass filter boards to provide ± 5V to the VTC4706 op-amps.

Front Panel

Shift Registers U201-U206 provide control signals for the front panel LEDs. Switches SW301-SW324 comprise the switch matrix which is read by the processor via input port U 301. LED digits DS101-DS106 are controlled via output ports U18-U25.

PARTS LIST

Front Panel Board Parts List

Ref No.	SRS Part No.	Value	Component Description
D 201	3-00012-306	GREEN	LED, Rectangular
D 202	3-00013-306	RED	LED, Rectangular
D 203	3-00012-306	GREEN	LED, Rectangular
D 204	3-00012-306	GREEN	LED, Rectangular
D 205	3-00012-306	GREEN	LED, Rectangular
D 206	3-00012-306	GREEN	LED, Rectangular
D 207	3-00012-306	GREEN	LED, Rectangular
D 208	3-00012-306	GREEN	LED, Rectangular
D 209	3-00012-306	GREEN	LED, Rectangular
D 210	3-00175-306	YELLOW	LED, Rectangular
D 211	3-00012-306	GREEN	LED, Rectangular
D 212	3-00012-306	GREEN	LED, Rectangular
D 213	3-00013-306	RED	LED, Rectangular
D 214	3-00013-306	RED	LED, Rectangular
D 215	3-00012-306	GREEN	LED, Rectangular
D 216	3-00012-306	GREEN	LED, Rectangular
D 217	3-00012-306	GREEN	LED, Rectangular
D 218	3-00012-306	GREEN	LED, Rectangular
D 219	3-00012-306	GREEN	LED, Rectangular
D 220	3-00012-306	GREEN	LED, Rectangular
D 221	3-00012-306	GREEN	LED, Rectangular
D 222	3-00012-306	GREEN	LED, Rectangular
D 223	3-00012-306	GREEN	LED, Rectangular
D 224	3-00012-306	GREEN	LED, Rectangular
D 225	3-00175-306	YELLOW	LED, Rectangular
D 226	3-00012-306	GREEN	LED, Rectangular
D 227	3-00012-306	GREEN	LED, Rectangular
D 228	3-00012-306	GREEN	LED, Rectangular
D 229	3-00012-306	GREEN	LED, Rectangular
D 230	3-00012-306	GREEN	LED, Rectangular
D 231	3-00012-306	GREEN	LED, Rectangular
D 232	3-00012-306	GREEN	LED, Rectangular
D 233	3-00175-306	YELLOW	LED, Rectangular
D 234	3-00012-306	GREEN	LED, Rectangular
D 235	3-00012-306	GREEN	LED, Rectangular
D 236	3-00013-306	RED	LED, Rectangular
D 237	3-00013-306	RED	LED, Rectangular
D 238	3-00012-306	GREEN	LED, Rectangular
D 239	3-00012-306	GREEN	LED, Rectangular
D 240	3-00012-306	GREEN	LED, Rectangular
D 241	3-00012-306	GREEN	LED, Rectangular
D 242	3-00012-306	GREEN	LED, Rectangular
D 243	3-00012-306	GREEN	LED, Rectangular
D 244	3-00012-306	GREEN	LED, Rectangular
D 245	3-00012-306	GREEN	LED, Rectangular
D 246	3-00012-306	GREEN	LED, Rectangular
D 247	3-00012-306	GREEN	LED, Rectangular
D 248	3-00012-306	GREEN	LED, Rectangular
D 249	3-00012-306	GREEN	LED, Rectangular
D 301	3-00004-301	1N4148	Diode

Parts List

D 302	3-00004-301	1N4148	Diode
D 303	3-00004-301	1N4148	Diode
DS101	3-00255-340	HDSP-5601	Integrated Circuit (Thru-hole Pkg)
DS102	3-00255-340	HDSP-5601	Integrated Circuit (Thru-hole Pkg)
DS103	3-00255-340	HDSP-5601	Integrated Circuit (Thru-hole Pkg)
DS104	3-00255-340	HDSP-5601	Integrated Circuit (Thru-hole Pkg)
DS105	3-00255-340	HDSP-5601	Integrated Circuit (Thru-hole Pkg)
DS106	3-00255-340	HDSP-5601	Integrated Circuit (Thru-hole Pkg)
J 101	1-00097-130	24 PIN DIL	Connector, Male
J 102	1-00097-130	24 PIN DIL	Connector, Male
J 103	1-00097-130	24 PIN DIL	Connector, Male
N 201	4-00252-425	100X5	Resistor Network SIP 1/4W 2% (Common)
N 202	4-00252-425	100X5	Resistor Network SIP 1/4W 2% (Common)
N 203	4-00252-425	100X5	Resistor Network SIP 1/4W 2% (Common)
N 204	4-00252-425	100X5	Resistor Network SIP 1/4W 2% (Common)
N 205	4-00252-425	100X5	Resistor Network SIP 1/4W 2% (Common)
N 301	4-00276-425	10KX9	Resistor Network SIP 1/4W 2% (Common)
R 202	4-00079-401	4.7K	Resistor, Carbon Film, 1/4W, 5%
SW301	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW302	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW303	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW304	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW305	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW306	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW307	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW308	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW309	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW310	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW311	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW312	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW313	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW314	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW315	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW316	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW317	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW318	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW319	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW320	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW321	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW322	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW323	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW324	2-00031-201	D6-01-05	Switch, Momentary Push Button
SW325	2-00031-201	D6-01-05	Switch, Momentary Push Button
U 201	3-00053-340	74LS164	Integrated Circuit (Thru-hole Pkg)
U 202	3-00053-340	74LS164	Integrated Circuit (Thru-hole Pkg)
U 203	3-00053-340	74LS164	Integrated Circuit (Thru-hole Pkg)
U 204	3-00053-340	74LS164	Integrated Circuit (Thru-hole Pkg)
U 205	3-00053-340	74LS164	Integrated Circuit (Thru-hole Pkg)
U 206	3-00053-340	74LS164	Integrated Circuit (Thru-hole Pkg)
U 301	3-00044-340	74HC244	Integrated Circuit (Thru-hole Pkg)
U 302	3-00254-340	74HC4002	Integrated Circuit (Thru-hole Pkg)
Z 0	0-00111-053	1-3/4"#24B	Wire #24 UL1007 Strip 1/4x1/4 Tin
Z 0	0-00112-053	1-3/4"#24R	Wire #24 UL1007 Strip 1/4x1/4 Tin
Z 0	0-00187-021	4-40X1/4PP	Screw, Panhead Phillips
Z 0	0-00255-044	SR640	Window
Z 0	1-00073-120	INSL	Connector, BNC
Z 0	7-00158-701	SR640-28	Printed Circuit Board

Z 0	7-00160-709	SR640-30	Lexan Overlay
Z 0	7-00174-710	SR640-29	Front Panel
Z 0	7-00273-709	SR645	Lexan Overlay
Z 0	7-00274-709	SR650	Lexan Overlay

Digital Board Parts List

Ref No.	SRS Part No.	Value	Component Description
B 1	6-00001-612	BR-2/3A 2PIN PC	Battery
C 1	5-00178-501	62P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 2	5-00040-509	1.0U	Capacitor, Electrolytic, 50V, 20%, Rad
C 3	5-00040-509	1.0U	Capacitor, Electrolytic, 50V, 20%, Rad
C 4	5-00178-501	62P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 5	5-00012-501	330P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 6	5-00012-501	330P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 7	5-00012-501	330P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 8	5-00012-501	330P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 9	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 101	5-00147-521	3300U	Capacitor, Electrolytic, 25V, 20%, Rad
C 102	5-00192-542	22U MIN	Cap, Mini Electrolytic, 50V, 20% Radial
C 103	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 104	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 105	5-00212-520	15000U	Capacitor, Electrolytic, 16V, 20%, Rad
C 106	5-00192-542	22U MIN	Cap, Mini Electrolytic, 50V, 20% Radial
C 107	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 108	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 109	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 110	5-00147-521	3300U	Capacitor, Electrolytic, 25V, 20%, Rad
C 111	5-00192-542	22U MIN	Cap, Mini Electrolytic, 50V, 20% Radial
C 112	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 113	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 114	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 115	5-00147-521	3300U	Capacitor, Electrolytic, 25V, 20%, Rad
C 116	5-00147-521	3300U	Capacitor, Electrolytic, 25V, 20%, Rad
C 117	5-00192-542	22U MIN	Cap, Mini Electrolytic, 50V, 20% Radial
C 118	5-00192-542	22U MIN	Cap, Mini Electrolytic, 50V, 20% Radial
C 119	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 120	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 121	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 122	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 123	5-00030-520	2200U	Capacitor, Electrolytic, 16V, 20%, Rad
C 150	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 151	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 152	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 153	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 154	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 155	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 156	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
D 1	3-00004-301	1N4148	Diode
D 2	3-00004-301	1N4148	Diode
D 3	3-00004-301	1N4148	Diode
D 101	3-00062-340	KBP201G/BR-81D	Integrated Circuit (Thru-hole Pkg)
D 103	3-00221-301	1N4004	Diode
D 104	3-00221-301	1N4004	Diode
D 105	3-00221-301	1N4004	Diode

Parts List

D 106	3-00221-301	1N4004	Diode
D 107	3-00062-340	KBP201G/BR-81D	Integrated Circuit (Thru-hole Pkg)
D 108	3-00062-340	KBP201G/BR-81D	Integrated Circuit (Thru-hole Pkg)
J 1	1-00238-161	GPIB SHIELDED	Connector, IEEE488, Reverse, R/A, Female
J 2	1-00016-160	RS232 25 PIN D	Connector, D-Sub, Right Angle PC, Female
J 3	1-00097-130	24 PIN DIL	Connector, Male
J 4	1-00097-130	24 PIN DIL	Connector, Male
J 5	1-00097-130	24 PIN DIL	Connector, Male
J 7	1-00096-130	10 PIN SI	Connector, Male
J 8	1-00096-130	10 PIN SI	Connector, Male
N 1	4-00419-420	150X8	Resistor Network, DIP, 1/4W,2%,8 Ind
N 2	4-00419-420	150X8	Resistor Network, DIP, 1/4W,2%,8 Ind
N 3	4-00419-420	150X8	Resistor Network, DIP, 1/4W,2%,8 Ind
N 4	4-00419-420	150X8	Resistor Network, DIP, 1/4W,2%,8 Ind
N 5	4-00419-420	150X8	Resistor Network, DIP, 1/4W,2%,8 Ind
N 6	4-00419-420	150X8	Resistor Network, DIP, 1/4W,2%,8 Ind
N 7	4-00261-425	2.2KX9	Resistor Network SIP 1/4W 2% (Common)
Q 1	3-00021-325	2N3904	Transistor, TO-92 Package
Q 2	3-00021-325	2N3904	Transistor, TO-92 Package
Q 3	3-00021-325	2N3904	Transistor, TO-92 Package
Q 101	3-00022-325	2N3906	Transistor, TO-92 Package
R 1	4-00034-401	10K	Resistor, Carbon Film, 1/4W, 5%
R 2	4-00032-401	100K	Resistor, Carbon Film, 1/4W, 5%
R 3	4-00034-401	10K	Resistor, Carbon Film, 1/4W, 5%
R 4	4-00054-401	200K	Resistor, Carbon Film, 1/4W, 5%
R 5	4-00022-401	1.0M	Resistor, Carbon Film, 1/4W, 5%
R 6	4-00062-401	270	Resistor, Carbon Film, 1/4W, 5%
R 7	4-00027-401	1.5K	Resistor, Carbon Film, 1/4W, 5%
R 8	4-00045-401	2.0K	Resistor, Carbon Film, 1/4W, 5%
R 9	4-00032-401	100K	Resistor, Carbon Film, 1/4W, 5%
R 10	4-00079-401	4.7K	Resistor, Carbon Film, 1/4W, 5%
R 11	4-00079-401	4.7K	Resistor, Carbon Film, 1/4W, 5%
R 12	4-00086-401	51	Resistor, Carbon Film, 1/4W, 5%
R 101	4-00372-431	50-30-25	Thermistor, PTC (Positive Temp Control)
R 102	4-00029-401	1.8K	Resistor, Carbon Film, 1/4W, 5%
R 103	4-00045-401	2.0K	Resistor, Carbon Film, 1/4W, 5%
R 104	4-00045-401	2.0K	Resistor, Carbon Film, 1/4W, 5%
R 105	4-00060-401	240	Resistor, Carbon Film, 1/4W, 5%
R 106	4-00475-407	2.61K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 107	4-00038-401	120	Resistor, Carbon Film, 1/4W, 5%
R 108	4-00439-407	1.33K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 109	4-00475-407	2.61K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 110	4-00060-401	240	Resistor, Carbon Film, 1/4W, 5%
R 111	4-00439-407	1.33K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 112	4-00038-401	120	Resistor, Carbon Film, 1/4W, 5%
SO1	1-00026-150	28 PIN 600 MIL	Socket, THRU-HOLE
SO3	1-00021-150	14 PIN 300 MIL	Socket, THRU-HOLE
SO6	1-00026-150	28 PIN 600 MIL	Socket, THRU-HOLE
SO7	1-00025-150	24 PIN 600 MIL	Socket, THRU-HOLE
SW1	2-00014-207	SPSTX8	Switch, DIP
U 2	3-00165-340	74HC08	Integrated Circuit (Thru-hole Pkg)
U 3	3-00051-340	74HCU04	Integrated Circuit (Thru-hole Pkg)
U 4	3-00298-340	Z80H	Integrated Circuit (Thru-hole Pkg)
U 5	3-00049-340	74HC74	Integrated Circuit (Thru-hole Pkg)
U 7	3-00081-341	2KX8-100	STATIC RAM, I.C.
U 8	3-00039-340	74HC14	Integrated Circuit (Thru-hole Pkg)
U 9	3-00045-340	74HC32	Integrated Circuit (Thru-hole Pkg)

U 10	3-00158-340	74HC154N	Integrated Circuit (Thru-hole Pkg)
U 11	3-00109-340	MC1488	Integrated Circuit (Thru-hole Pkg)
U 12	3-00645-340	NAT9914APD	Integrated Circuit (Thru-hole Pkg)
U 13	3-00078-340	DS75160A	Integrated Circuit (Thru-hole Pkg)
U 14	3-00079-340	DS75161A	Integrated Circuit (Thru-hole Pkg)
U 15	3-00247-340	SCN2641	Integrated Circuit (Thru-hole Pkg)
U 16	3-00110-340	MC1489	Integrated Circuit (Thru-hole Pkg)
U 17	3-00044-340	74HC244	Integrated Circuit (Thru-hole Pkg)
U 18	3-00046-340	74HC374	Integrated Circuit (Thru-hole Pkg)
U 19	3-00300-340	74LS374	Integrated Circuit (Thru-hole Pkg)
U 20	3-00300-340	74LS374	Integrated Circuit (Thru-hole Pkg)
U 21	3-00044-340	74HC244	Integrated Circuit (Thru-hole Pkg)
U 22	3-00300-340	74LS374	Integrated Circuit (Thru-hole Pkg)
U 23	3-00300-340	74LS374	Integrated Circuit (Thru-hole Pkg)
U 24	3-00300-340	74LS374	Integrated Circuit (Thru-hole Pkg)
U 25	3-00300-340	74LS374	Integrated Circuit (Thru-hole Pkg)
U 102	3-00149-329	LM317T	Voltage Reg., TO-220 (TAB) Package
U 103	3-00141-329	LM337T	Voltage Reg., TO-220 (TAB) Package
U 104	3-00149-329	LM317T	Voltage Reg., TO-220 (TAB) Package
U 105	3-00141-329	LM337T	Voltage Reg., TO-220 (TAB) Package
X 1	6-00037-620	3.6864 MHZ	Crystal
Z 0	0-00435-000	#30 - 1/8 DRILL	Hardware, Misc.
Z 0	0-00447-007	TO-220	Heat Sinks
Z 0	1-00091-114	10 PIN, WHITE	Header, Amp, MTA-100
Z 0	7-00221-701	SR640-45	Printed Circuit Board

Filter Board Parts List

Ref No.	SRS Part No.	Value	Component Description
C 1	5-00060-512	1.0U	Cap, Stacked Metal Film 50V 5% -40/+85c
C 2	5-00060-512	1.0U	Cap, Stacked Metal Film 50V 5% -40/+85c
C 3	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 4	5-00038-509	10U	Capacitor, Electrolytic, 50V, 20%, Rad
C 5	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 7	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 8	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 9	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 10	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 11	5-00008-501	22P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 12	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 13	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 14	5-00040-509	1.0U	Capacitor, Electrolytic, 50V, 20%, Rad
C 40	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 41	5-00003-501	10P	Capacitor, Ceramic Disc, 50V, 10%, SL
C 42	5-00040-509	1.0U	Capacitor, Electrolytic, 50V, 20%, Rad
C 43	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 44	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 45	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 46	5-00100-517	2.2U	Capacitor, Tantalum, 35V, 20%, Rad
C 47	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 48	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 120	5-00148-545	1000P	Capacitor, Monolythic Ceramic, COG, 1%
C 121	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 122	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 123	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate

C 124	5-00139-516	910P	Capacitor, Silver Mica, 500V, 5%, DM15
C 125	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 126	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 127	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 130	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 131	5-00207-532	43P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 131*	5-00226-532	33P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 132	5-00207-532	43P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 133	5-00204-523	3P	Capacitor, Silver Mica, Miniature
C 135	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 136	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 137	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 138	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 220	5-00148-545	1000P	Capacitor, Monolythic Ceramic, COG, 1%
C 221	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 222	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 223	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 224	5-00139-516	910P	Capacitor, Silver Mica, 500V, 5%, DM15
C 225	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 226	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 227	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 230	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 231	5-00207-532	43P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 231*	5-00179-532	15P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 232	5-00207-532	43P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 233	5-00204-523	3P	Capacitor, Silver Mica, Miniature
C 235	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 236	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 237	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 238	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 320	5-00148-545	1000P	Capacitor, Monolythic Ceramic, COG, 1%
C 321	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 322	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 323	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 324	5-00139-516	910P	Capacitor, Silver Mica, 500V, 5%, DM15
C 325	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 326	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 327	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 330	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 331	5-00208-532	36P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 331*	5-00210-532	27P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 332	5-00207-532	43P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 333	5-00204-523	3P	Capacitor, Silver Mica, Miniature
C 335	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 336	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 337	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 338	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 420	5-00148-545	1000P	Capacitor, Monolythic Ceramic, COG, 1%
C 421	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 422	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 423	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 424	5-00139-516	910P	Capacitor, Silver Mica, 500V, 5%, DM15
C 425	5-00149-545	.01U	Capacitor, Monolythic Ceramic, COG, 1%
C 426	5-00181-540	.1U	Capacitor, Metallized Polycarbonate
C 427	5-00160-540	1.0U	Capacitor, Metallized Polycarbonate
C 430	5-00023-529	.1U	Cap, Monolythic Ceramic, 50V, 20%, Z5U
C 431	5-00209-532	30P	Capacitor, Ceramic Disc, 50V, 10% NPO

C 431*	5-00210-532	27P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 432	5-00207-532	43P	Capacitor, Ceramic Disc, 50V, 10% NPO
C 433	5-00204-523	3P	Capacitor, Silver Mica, Miniature
C 435	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 436	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 437	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
C 438	5-00098-517	10U	Capacitor, Tantalum, 35V, 20%, Rad
D 21	3-00230-301	1N5240A	Diode
D 22	3-00004-301	1N4148	Diode
D 100	3-00004-301	1N4148	Diode
D 101	3-00004-301	1N4148	Diode
D 102	3-00004-301	1N4148	Diode
D 103	3-00004-301	1N4148	Diode
D 104	3-00004-301	1N4148	Diode
D 105	3-00004-301	1N4148	Diode
D 106	3-00004-301	1N4148	Diode
D 107	3-00004-301	1N4148	Diode
D 108	3-00004-301	1N4148	Diode
D 109	3-00004-301	1N4148	Diode
D 110	3-00004-301	1N4148	Diode
D 111	3-00004-301	1N4148	Diode
D 112	3-00004-301	1N4148	Diode
D 113	3-00004-301	1N4148	Diode
D 114	3-00004-301	1N4148	Diode
D 115	3-00004-301	1N4148	Diode
D 116	3-00004-301	1N4148	Diode
D 117	3-00004-301	1N4148	Diode
D 118	3-00004-301	1N4148	Diode
D 119	3-00004-301	1N4148	Diode
D 200	3-00004-301	1N4148	Diode
D 201	3-00004-301	1N4148	Diode
D 202	3-00004-301	1N4148	Diode
D 203	3-00004-301	1N4148	Diode
D 204	3-00004-301	1N4148	Diode
D 205	3-00004-301	1N4148	Diode
D 206	3-00004-301	1N4148	Diode
D 207	3-00004-301	1N4148	Diode
D 208	3-00004-301	1N4148	Diode
D 209	3-00004-301	1N4148	Diode
D 210	3-00004-301	1N4148	Diode
D 211	3-00004-301	1N4148	Diode
D 212	3-00004-301	1N4148	Diode
D 213	3-00004-301	1N4148	Diode
D 214	3-00004-301	1N4148	Diode
D 215	3-00004-301	1N4148	Diode
D 216	3-00004-301	1N4148	Diode
D 217	3-00004-301	1N4148	Diode
D 218	3-00004-301	1N4148	Diode
D 219	3-00004-301	1N4148	Diode
D 300	3-00004-301	1N4148	Diode
D 301	3-00004-301	1N4148	Diode
D 302	3-00004-301	1N4148	Diode
D 303	3-00004-301	1N4148	Diode
D 304	3-00004-301	1N4148	Diode
D 305	3-00004-301	1N4148	Diode
D 306	3-00004-301	1N4148	Diode
D 307	3-00004-301	1N4148	Diode

Parts List

D 308	3-00004-301	1N4148	Diode
D 309	3-00004-301	1N4148	Diode
D 310	3-00004-301	1N4148	Diode
D 311	3-00004-301	1N4148	Diode
D 312	3-00004-301	1N4148	Diode
D 313	3-00004-301	1N4148	Diode
D 314	3-00004-301	1N4148	Diode
D 315	3-00004-301	1N4148	Diode
D 316	3-00004-301	1N4148	Diode
D 317	3-00004-301	1N4148	Diode
D 318	3-00004-301	1N4148	Diode
D 319	3-00004-301	1N4148	Diode
D 400	3-00004-301	1N4148	Diode
D 401	3-00004-301	1N4148	Diode
D 402	3-00004-301	1N4148	Diode
D 403	3-00004-301	1N4148	Diode
D 404	3-00004-301	1N4148	Diode
D 405	3-00004-301	1N4148	Diode
D 406	3-00004-301	1N4148	Diode
D 407	3-00004-301	1N4148	Diode
D 408	3-00004-301	1N4148	Diode
D 409	3-00004-301	1N4148	Diode
D 410	3-00004-301	1N4148	Diode
D 411	3-00004-301	1N4148	Diode
D 412	3-00004-301	1N4148	Diode
D 413	3-00004-301	1N4148	Diode
D 414	3-00004-301	1N4148	Diode
D 415	3-00004-301	1N4148	Diode
D 416	3-00004-301	1N4148	Diode
D 417	3-00004-301	1N4148	Diode
D 418	3-00004-301	1N4148	Diode
D 419	3-00004-301	1N4148	Diode
DU25	3-00230-301	1N5240A	Diode
J 4	1-00096-130	10 PIN SI	Connector, Male
JP101	1-00006-130	2 PIN DI	Connector, Male
JP102	1-00006-130	2 PIN DI	Connector, Male
JP103	1-00006-130	2 PIN DI	Connector, Male
JP104	1-00006-130	2 PIN DI	Connector, Male
JP105	1-00006-130	2 PIN DI	Connector, Male
JP201	1-00006-130	2 PIN DI	Connector, Male
JP202	1-00006-130	2 PIN DI	Connector, Male
JP203	1-00006-130	2 PIN DI	Connector, Male
JP204	1-00006-130	2 PIN DI	Connector, Male
JP301	1-00006-130	2 PIN DI	Connector, Male
JP302	1-00006-130	2 PIN DI	Connector, Male
JP303	1-00006-130	2 PIN DI	Connector, Male
JP304	1-00006-130	2 PIN DI	Connector, Male
JP401	1-00006-130	2 PIN DI	Connector, Male
JP402	1-00006-130	2 PIN DI	Connector, Male
JP403	1-00006-130	2 PIN DI	Connector, Male
JP404	1-00006-130	2 PIN DI	Connector, Male
K 1	3-00240-335	HS-211-12	Relay
K 2	3-00240-335	HS-211-12	Relay
K 3	3-00239-335	HS-212-12	Relay
K 4	3-00239-335	HS-212-12	Relay
K 105	3-00239-335	HS-212-12	Relay
K 106	3-00239-335	HS-212-12	Relay

K 205	3-00239-335	HS-212-12	Relay
K 206	3-00239-335	HS-212-12	Relay
K 305	3-00239-335	HS-212-12	Relay
K 306	3-00239-335	HS-212-12	Relay
K 405	3-00239-335	HS-212-12	Relay
K 406	3-00239-335	HS-212-12	Relay
L 101	6-00006-602	33U	Inductor, Radial
L 101*	6-00036-602	100U	Inductor, Radial
L 201	6-00006-602	33U	Inductor, Radial
L 301	6-00006-602	33U	Inductor, Radial
N 1	4-00252-425	100X5	Resistor Network SIP 1/4W 2% (Common)
N 2	4-00298-425	470X5	Resistor Network SIP 1/4W 2% (Common)
N 3	4-00293-421	470X4	Res. Network, SIP, 1/4W,2% (Isolated)
N 4	4-00549-425	100KX5	Resistor Network SIP 1/4W 2% (Common)
N 5	4-00549-425	100KX5	Resistor Network SIP 1/4W 2% (Common)
P 1	4-00535-450	50	Pot, Multi-Turn Trim, End Adj., Side Mt.
P 2	4-00486-441	50	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 3	4-00487-441	20	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 105	4-00353-441	100	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 205	4-00326-441	200	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 206	4-00485-441	1K	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 305	4-00370-441	500	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 306	4-00485-441	1K	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 405	4-00485-441	1K	Pot, Multi-Turn Trim, 3/8" Square Top Ad
P 406	4-00485-441	1K	Pot, Multi-Turn Trim, 3/8" Square Top Ad
Q 22	3-00021-325	2N3904	Transistor, TO-92 Package
Q 100	3-00030-325	J310	Transistor, TO-92 Package
Q 101	3-00030-325	J310	Transistor, TO-92 Package
Q 102	3-00030-325	J310	Transistor, TO-92 Package
Q 103	3-00030-325	J310	Transistor, TO-92 Package
Q 104	3-00030-325	J310	Transistor, TO-92 Package
Q 105	3-00030-325	J310	Transistor, TO-92 Package
Q 106	3-00030-325	J310	Transistor, TO-92 Package
Q 107	3-00030-325	J310	Transistor, TO-92 Package
Q 108	3-00030-325	J310	Transistor, TO-92 Package
Q 109	3-00030-325	J310	Transistor, TO-92 Package
Q 110	3-00030-325	J310	Transistor, TO-92 Package
Q 111	3-00030-325	J310	Transistor, TO-92 Package
Q 112	3-00030-325	J310	Transistor, TO-92 Package
Q 113	3-00030-325	J310	Transistor, TO-92 Package
Q 114	3-00030-325	J310	Transistor, TO-92 Package
Q 115	3-00030-325	J310	Transistor, TO-92 Package
Q 116	3-00030-325	J310	Transistor, TO-92 Package
Q 117	3-00030-325	J310	Transistor, TO-92 Package
Q 118	3-00030-325	J310	Transistor, TO-92 Package
Q 119	3-00030-325	J310	Transistor, TO-92 Package
Q 200	3-00030-325	J310	Transistor, TO-92 Package
Q 201	3-00030-325	J310	Transistor, TO-92 Package
Q 202	3-00030-325	J310	Transistor, TO-92 Package
Q 203	3-00030-325	J310	Transistor, TO-92 Package
Q 204	3-00030-325	J310	Transistor, TO-92 Package
Q 205	3-00030-325	J310	Transistor, TO-92 Package
Q 206	3-00030-325	J310	Transistor, TO-92 Package
Q 207	3-00030-325	J310	Transistor, TO-92 Package
Q 208	3-00030-325	J310	Transistor, TO-92 Package
Q 209	3-00030-325	J310	Transistor, TO-92 Package
Q 210	3-00030-325	J310	Transistor, TO-92 Package

Q 211	3-00030-325	J310	Transistor, TO-92 Package
Q 212	3-00030-325	J310	Transistor, TO-92 Package
Q 213	3-00030-325	J310	Transistor, TO-92 Package
Q 214	3-00030-325	J310	Transistor, TO-92 Package
Q 215	3-00030-325	J310	Transistor, TO-92 Package
Q 216	3-00030-325	J310	Transistor, TO-92 Package
Q 217	3-00030-325	J310	Transistor, TO-92 Package
Q 218	3-00030-325	J310	Transistor, TO-92 Package
Q 219	3-00030-325	J310	Transistor, TO-92 Package
Q 300	3-00030-325	J310	Transistor, TO-92 Package
Q 301	3-00030-325	J310	Transistor, TO-92 Package
Q 302	3-00030-325	J310	Transistor, TO-92 Package
Q 303	3-00030-325	J310	Transistor, TO-92 Package
Q 304	3-00030-325	J310	Transistor, TO-92 Package
Q 305	3-00030-325	J310	Transistor, TO-92 Package
Q 306	3-00030-325	J310	Transistor, TO-92 Package
Q 307	3-00030-325	J310	Transistor, TO-92 Package
Q 308	3-00030-325	J310	Transistor, TO-92 Package
Q 309	3-00030-325	J310	Transistor, TO-92 Package
Q 310	3-00030-325	J310	Transistor, TO-92 Package
Q 311	3-00030-325	J310	Transistor, TO-92 Package
Q 312	3-00030-325	J310	Transistor, TO-92 Package
Q 313	3-00030-325	J310	Transistor, TO-92 Package
Q 314	3-00030-325	J310	Transistor, TO-92 Package
Q 315	3-00030-325	J310	Transistor, TO-92 Package
Q 316	3-00030-325	J310	Transistor, TO-92 Package
Q 317	3-00030-325	J310	Transistor, TO-92 Package
Q 318	3-00030-325	J310	Transistor, TO-92 Package
Q 319	3-00030-325	J310	Transistor, TO-92 Package
Q 400	3-00030-325	J310	Transistor, TO-92 Package
Q 401	3-00030-325	J310	Transistor, TO-92 Package
Q 402	3-00030-325	J310	Transistor, TO-92 Package
Q 403	3-00030-325	J310	Transistor, TO-92 Package
Q 404	3-00030-325	J310	Transistor, TO-92 Package
Q 405	3-00030-325	J310	Transistor, TO-92 Package
Q 406	3-00030-325	J310	Transistor, TO-92 Package
Q 407	3-00030-325	J310	Transistor, TO-92 Package
Q 408	3-00030-325	J310	Transistor, TO-92 Package
Q 409	3-00030-325	J310	Transistor, TO-92 Package
Q 410	3-00030-325	J310	Transistor, TO-92 Package
Q 411	3-00030-325	J310	Transistor, TO-92 Package
Q 412	3-00030-325	J310	Transistor, TO-92 Package
Q 413	3-00030-325	J310	Transistor, TO-92 Package
Q 414	3-00030-325	J310	Transistor, TO-92 Package
Q 415	3-00030-325	J310	Transistor, TO-92 Package
Q 416	3-00030-325	J310	Transistor, TO-92 Package
Q 417	3-00030-325	J310	Transistor, TO-92 Package
Q 418	3-00030-325	J310	Transistor, TO-92 Package
Q 419	3-00030-325	J310	Transistor, TO-92 Package
R 1	4-00022-401	1.0M	Resistor, Carbon Film, 1/4W, 5%
R 2	4-00022-401	1.0M	Resistor, Carbon Film, 1/4W, 5%
R 3	4-00045-401	2.0K	Resistor, Carbon Film, 1/4W, 5%
R 4	4-00272-407	221	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 5	4-00081-401	470	Resistor, Carbon Film, 1/4W, 5%
R 6	4-00081-401	470	Resistor, Carbon Film, 1/4W, 5%
R 7	4-00409-408	1.210K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 8	4-00409-408	1.210K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm

R 9	4-00476-408	976.0	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 10	4-00145-407	110	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 11	4-00145-407	110	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 12	4-00047-401	2.2	Resistor, Carbon Film, 1/4W, 5%
R 13	4-00047-401	2.2	Resistor, Carbon Film, 1/4W, 5%
R 14	4-00358-402	510	Resistor, Carbon Comp, 1/2W, 5%
R 15	4-00196-407	6.04K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 16	4-00210-407	9.09K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 17	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 18	4-00056-401	22	Resistor, Carbon Film, 1/4W, 5%
R 19	4-00215-407	909	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 20	4-00141-407	100	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 21	4-00215-407	909	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 22	4-00141-407	100	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 23	4-00411-407	1.37K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 24	4-00477-407	432	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 25	4-00165-407	200	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 26	4-00215-407	909	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 27	4-00141-407	100	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 27*	4-00152-407	140	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 28	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 29	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 30	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 31	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 32	4-00151-407	130K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 33	4-00479-407	66.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 33*	4-00569-407	44.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 34	4-00479-407	66.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 34*	4-00569-407	44.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 35	4-00151-407	130K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 36	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
R 39	4-00079-401	4.7K	Resistor, Carbon Film, 1/4W, 5%
R 77	4-00052-401	20	Resistor, Carbon Film, 1/4W, 5%
R 80	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 81	4-00158-407	2.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 82	4-00483-407	1.05K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 83	4-00483-407	1.05K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 84	4-00158-407	2.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 85	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
R 86	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 87	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 88	4-00084-401	5.1K	Resistor, Carbon Film, 1/4W, 5%
R 89	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 90	4-00141-407	100	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 90*	4-00241-407	787	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 91	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 92	4-00467-407	2.43K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 92*	4-00237-407	4.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 93	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 94	4-00212-407	9.76K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 94*	4-00157-407	16.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 96	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 97	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 98	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 99	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 140	4-00405-407	2.49M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 140*	4-00131-407	1.00M	Resistor, Metal Film, 1/8W, 1%, 50PPM

R 141	4-00401-407	1.24M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 141*	4-00398-407	499K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 142	4-00399-407	634K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 142*	4-00518-407	255K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 143	4-00395-407	316K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 143*	4-00598-407	127K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 144	4-00393-407	158K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 144*	4-00584-407	63.4K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 145	4-00391-407	78.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 145*	4-00386-407	30.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 146	4-00387-407	39.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 146*	4-00600-407	15.8K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 147	4-00332-407	19.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 147*	4-00303-407	7.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 148	4-00212-407	9.76K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 148*	4-00607-407	3.92K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 149	4-00237-407	4.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 149*	4-00601-407	1.96K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 150	4-00405-407	2.49M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 150*	4-00131-407	1.00M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 151	4-00401-407	1.24M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 151*	4-00398-407	499K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 152	4-00399-407	634K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 152*	4-00518-407	255K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 153	4-00395-407	316K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 153*	4-00598-407	127K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 154	4-00393-407	158K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 154*	4-00584-407	63.4K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 155	4-00391-407	78.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 155*	4-00386-407	30.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 156	4-00387-407	39.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 156*	4-00600-407	15.8K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 157	4-00332-407	19.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 157*	4-00303-407	7.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 158	4-00212-407	9.76K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 158*	4-00607-407	3.92K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 159	4-00237-407	4.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 159*	4-00601-407	1.96K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 160	4-00479-407	66.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 160*	4-00446-407	47.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 161	4-00446-407	47.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 162	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 163	4-00138-407	10.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 164	4-00329-407	402	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 165	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 166	4-00278-407	10.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 167	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 168	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 169	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 170	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 172	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
R 173	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 174	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 175	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 176	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 177	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 240	4-00404-407	1.96M	Resistor, Metal Film, 1/8W, 1%, 50PPM

R 240*	4-00401-407	1.24M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 241	4-00131-407	1.00M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 241*	4-00339-407	634K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 242	4-00398-407	499K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 242*	4-00604-407	324K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 243	4-00170-407	249K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 243*	4-00558-407	162K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 244	4-00389-407	124K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 244*	4-00480-407	80.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 245	4-00390-407	61.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 245*	4-00387-407	39.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 246	4-00386-407	30.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 246*	4-00164-407	20.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 247	4-00384-407	15.4K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 247*	4-00138-407	10.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 248	4-00381-407	7.68K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 248*	4-00188-407	4.99K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 249	4-00178-407	3.83K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 249*	4-00161-407	2.49K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 250	4-00404-407	1.96M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 250*	4-00401-407	1.24M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 251	4-00131-407	1.00M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 251*	4-00399-407	634K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 252	4-00398-407	499K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 252*	4-00604-407	324K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 253	4-00170-407	249K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 253*	4-00558-407	162K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 254	4-00389-407	124K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 254*	4-00480-407	80.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 255	4-00390-407	61.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 255*	4-00387-407	39.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 256	4-00386-407	30.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 256*	4-00164-407	20.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 257	4-00384-407	15.4K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 257*	4-00138-407	10.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 258	4-00381-407	7.68K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 258*	4-00188-407	4.99K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 259	4-00178-407	3.83K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 259*	4-00161-407	2.49K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 260	4-00479-407	66.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 260*	4-00446-407	47.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 261	4-00480-407	80.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 262	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 263	4-00138-407	10.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 264	4-00523-407	649	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 265	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 266	4-00278-407	10.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 267	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 268	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 269	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 270	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 271	4-00176-407	3.01K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 272	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
R 273	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 274	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 275	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 276	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%

R 277	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 340	4-00403-407	1.62M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 340*	4-00403-407	1.62M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 341	4-00207-407	806K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 341*	4-00606-407	787K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 342	4-00397-407	402K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 342*	4-00602-407	392K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 343	4-00166-407	200K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 343*	4-00594-407	196K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 344	4-00142-407	100K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 344*	4-00520-407	97.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 345	4-00192-407	49.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 345*	4-00514-407	48.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 346	4-00171-407	25.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 346*	4-00597-407	24.3K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 347	4-00383-407	12.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 347*	4-00148-407	12.1K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 348	4-00380-407	6.34K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 348*	4-00196-407	6.04K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 349	4-00377-407	3.16K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 349*	4-00176-407	3.01K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 350	4-00403-407	1.62M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 350*	4-00403-407	1.62M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 351	4-00207-407	806K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 351*	4-00606-407	787K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 352	4-00397-407	402K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 352*	4-00602-407	392K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 353	4-00166-407	200K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 353*	4-00594-407	196K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 354	4-00142-407	100K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 354*	4-00520-407	97.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 355	4-00192-407	49.9K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 355*	4-00514-407	48.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 356	4-00171-407	25.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 356*	4-00597-407	24.3K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 357	4-00383-407	12.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 357*	4-00148-407	12.1K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 358	4-00380-407	6.34K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 358*	4-00196-407	6.04K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 359	4-00377-407	3.16K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 359*	4-00176-407	3.01K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 360	4-00479-407	66.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 360*	4-00432-407	56.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 361	4-00480-407	80.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 362	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 363	4-00138-407	10.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 364	4-00483-407	1.05K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 365	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 366	4-00278-407	10.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 367	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 368	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 369	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 370	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 371	4-00351-407	2.32K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 372	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
R 373	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 374	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%

R 375	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 376	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 377	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
R 415	4-00007-440	20K	Trim Pot, Single Turn, In-Line Leads
R 440	4-00402-407	1.47M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 440*	4-00609-407	1.69M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 441	4-00400-407	732K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 441A*	4-00605-407	105K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 441B*	4-00205-407	750K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 442	4-00396-407	374K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 442*	4-00599-407	422K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 443	4-00394-407	187K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 443*	4-00596-407	215K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 444	4-00392-407	93.1K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 444*	4-00608-407	107K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 445	4-00388-407	46.4K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 445*	4-00603-407	53.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 446	4-00385-407	23.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 446*	4-00484-407	26.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 447	4-00382-407	11.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 447*	4-00595-407	13.3K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 448	4-00379-407	5.76K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 448*	4-00198-407	6.65K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 449	4-00376-407	2.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 449*	4-00309-407	3.32K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 450	4-00402-407	1.47M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 450*	4-00609-407	1.69M	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 451	4-00400-407	732K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 451A*	4-00605-407	105K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 451B*	4-00205-407	750K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 452	4-00396-407	374K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 452*	4-00599-407	422K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 453	4-00394-407	187K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 453*	4-00596-407	215K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 454	4-00392-407	93.1K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 454*	4-00608-407	107K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 455	4-00388-407	46.4K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 455*	4-00603-407	53.6K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 456	4-00385-407	23.2K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 456*	4-00484-407	26.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 457	4-00382-407	11.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 457*	4-00595-407	13.3K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 458	4-00379-407	5.76K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 458*	4-00198-407	6.65K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 459	4-00376-407	2.87K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 459*	4-00309-407	3.32K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 460	4-00479-407	66.5K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 461	4-00389-407	124K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 462	4-00130-407	1.00K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 463	4-00138-407	10.0K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 464	4-00160-407	2.26K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 465	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 466	4-00278-407	10.7K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 467	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 468	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 469	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm
R 470	4-00218-408	10.00K	Resistor, Metal Film, 1/8W, 0.1%, 25ppm

R 471	4-00196-407	6.04K	Resistor, Metal Film, 1/8W, 1%, 50PPM
R 472	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
R 473	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 474	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 475	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 476	4-00031-401	100	Resistor, Carbon Film, 1/4W, 5%
R 477	4-00030-401	10	Resistor, Carbon Film, 1/4W, 5%
RC21	5-00254-501	130P	Capacitor, Ceramic Disc, 50V, 10%, SL
RC21*	5-00254-501	130P	Capacitor, Ceramic Disc, 50V, 10%, SL
RC26	5-00005-501	150P	Capacitor, Ceramic Disc, 50V, 10%, SL
RC26*	5-00254-501	130P	Capacitor, Ceramic Disc, 50V, 10%, SL
RC90*	5-00003-501	10P	Capacitor, Ceramic Disc, 50V, 10%, SL
RC94	5-00009-501	24P	Capacitor, Ceramic Disc, 50V, 10%, SL
RU25	4-00021-401	1.0K	Resistor, Carbon Film, 1/4W, 5%
RX172	0-00112-053	1-3/4"#24R	Wire #24 UL1007 Strip 1/4x1/4 Tin
U 1	3-00088-340	LF353	Integrated Circuit (Thru-hole Pkg)
U 2	3-00246-340	NPD5564	Integrated Circuit (Thru-hole Pkg)
U 3	3-00252-340	LT1037	Integrated Circuit (Thru-hole Pkg)
U 4	3-00252-340	LT1037	Integrated Circuit (Thru-hole Pkg)
U 5	3-00076-340	DG211	Integrated Circuit (Thru-hole Pkg)
U 6	3-00252-340	LT1037	Integrated Circuit (Thru-hole Pkg)
U 7	3-00076-340	DG211	Integrated Circuit (Thru-hole Pkg)
U 8	3-00252-340	LT1037	Integrated Circuit (Thru-hole Pkg)
U 9	3-00076-340	DG211	Integrated Circuit (Thru-hole Pkg)
U 10	3-00143-340	LM393	Integrated Circuit (Thru-hole Pkg)
U 11	3-00250-340	PS2401A-2	Integrated Circuit (Thru-hole Pkg)
U 16	3-00076-340	DG211	Integrated Circuit (Thru-hole Pkg)
U 17	3-00058-340	AD7524	Integrated Circuit (Thru-hole Pkg)
U 18	3-00297-340	LT1028	Integrated Circuit (Thru-hole Pkg)
U 19	3-00106-340	LT1007	Integrated Circuit (Thru-hole Pkg)
U 19*	3-00297-340	LT1028	Integrated Circuit (Thru-hole Pkg)
U 20	3-00143-340	LM393	Integrated Circuit (Thru-hole Pkg)
U 21	3-00076-340	DG211	Integrated Circuit (Thru-hole Pkg)
U 22	3-00189-340	LF356	Integrated Circuit (Thru-hole Pkg)
U 23	3-00320-340	LT1010	Integrated Circuit (Thru-hole Pkg)
U 24	3-00249-340	PS2401A-4	Integrated Circuit (Thru-hole Pkg)
U 25	3-00245-340	UCN5818A	Integrated Circuit (Thru-hole Pkg)
U 26	3-00244-340	UCN5832A	Integrated Circuit (Thru-hole Pkg)
U 27*	0-00001-340	Wire	Hardware, Miscellanous
U 28*	0-00001-340	Wire	Hardware, Miscellanous
U 112	3-00241-340	AD7528JN	Integrated Circuit (Thru-hole Pkg)
U 113	3-00087-340	LF347	Integrated Circuit (Thru-hole Pkg)
U 114	3-00296-340	OPA404	Integrated Circuit (Thru-hole Pkg)
U 114*	3-00553-340	OP467GP	Integrated Circuit (Thru-hole Pkg)
U 115	3-00189-340	LF356	Integrated Circuit (Thru-hole Pkg)
U 212	3-00241-340	AD7528JN	Integrated Circuit (Thru-hole Pkg)
U 213	3-00087-340	LF347	Integrated Circuit (Thru-hole Pkg)
U 214	3-00296-340	OPA404	Integrated Circuit (Thru-hole Pkg)
U 214*	3-00553-340	OP467GP	Integrated Circuit (Thru-hole Pkg)
U 215	3-00189-340	LF356	Integrated Circuit (Thru-hole Pkg)
U 312	3-00241-340	AD7528JN	Integrated Circuit (Thru-hole Pkg)
U 313	3-00087-340	LF347	Integrated Circuit (Thru-hole Pkg)
U 314	3-00296-340	OPA404	Integrated Circuit (Thru-hole Pkg)
U 314*	3-00553-340	OP467GP	Integrated Circuit (Thru-hole Pkg)
U 315	3-00189-340	LF356	Integrated Circuit (Thru-hole Pkg)
U 412	3-00241-340	AD7528JN	Integrated Circuit (Thru-hole Pkg)
U 413	3-00087-340	LF347	Integrated Circuit (Thru-hole Pkg)

U 414	3-00296-340	OPA404	Integrated Circuit (Thru-hole Pkg)
U 414*	3-00553-340	OP467GP	Integrated Circuit (Thru-hole Pkg)
U 415	3-00189-340	LF356	Integrated Circuit (Thru-hole Pkg)
Z 0	0-00478-055	1.5"X#30 BLK	Wire, Other
Z 0	7-00159-701	SR643 ANALOG	Printed Circuit Board
Z 0	9-00494-924	COPPER FOIL,1/4	Tape, All types

* High-pass board component

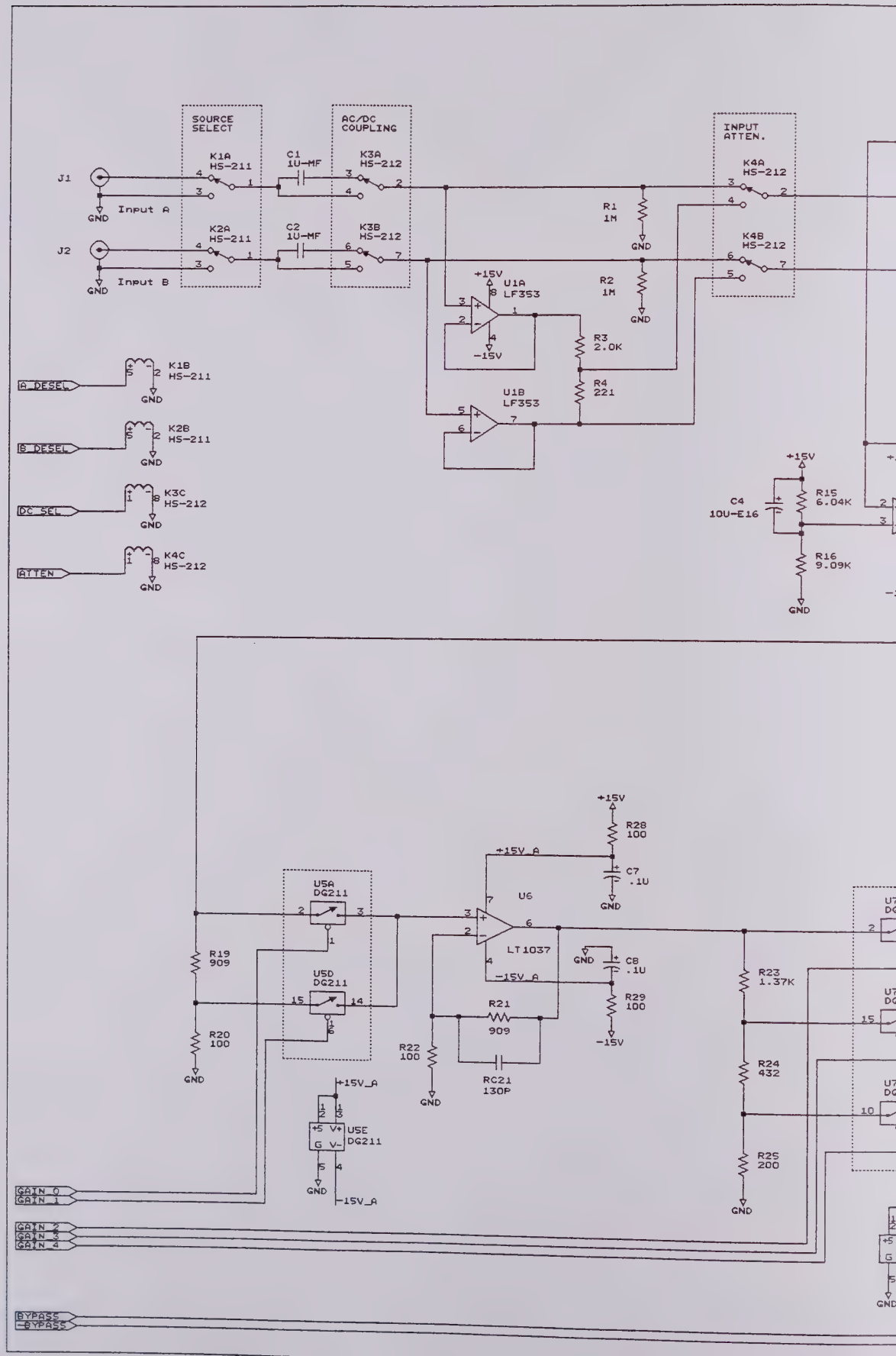
Chassis Assembly Parts List

Ref No.	SRS Part No.	Value	Component Description
D 200	3-00329-301	1N5235	Diode
F 1	0-00014-002	6J4	Power_Entry Hardware
J 101	1-00003-120	BNC	Connector, BNC
J 102	1-00003-120	BNC	Connector, BNC
Q 102	3-00233-329	TIP31B	Voltage Reg., TO-220 (TAB) Package
SW101	2-00023-218	DPDT	Switch, Panel Mount, Power, Rocker
T 101	6-00034-610	SR640	Transformer
U 101	3-00112-329	7805	Voltage Reg., TO-220 (TAB) Package
Z 0	0-00016-000	TIE ANCHOR	Hardware, Misc.
Z 0	0-00017-002	TRANSCOVER	Power_Entry Hardware
Z 0	0-00025-005	3/8"	Lugs
Z 0	0-00043-011	4-40 KEP	Nut, Kep
Z 0	0-00048-011	6-32 KEP	Nut, Kep
Z 0	0-00079-031	4-40X3/16 M/F	Standoff
Z 0	0-00089-033	4"	Tie
Z 0	0-00096-041	#4 SPLIT	Washer, Split
Z 0	0-00098-042	#6 LOCK	Washer, lock
Z 0	0-00150-026	4-40X1/4PF	Screw, Black, All Types
Z 0	0-00153-057	GROMMET2	Grommet
Z 0	0-00158-000	60MM 24V	Hardware, Misc.
Z 0	0-00185-021	6-32X3/8PP	Screw, Panhead Phillips
Z 0	0-00186-021	6-32X1-3/8PP	Screw, Panhead Phillips
Z 0	0-00187-021	4-40X1/4PP	Screw, Panhead Phillips
Z 0	0-00190-030	#8X1"	Spacer
Z 0	0-00231-043	#4 SHOULDER	Washer, nylon
Z 0	0-00237-016	F1404	Power Button
Z 0	0-00240-026	4-40X3/8PF	Screw, Black, All Types
Z 0	0-00243-003	TO-220	Insulators
Z 0	0-00250-000	HANDLE2	Hardware, Misc.
Z 0	0-00256-043	#6 SHOULDER	Washer, nylon
Z 0	0-00267-052	6-1/2" #22 RED	Wire #22 UL1007
Z 0	0-00268-052	6-1/2" #22 BL	Wire #22 UL1007
Z 0	0-00269-052	7-3/4" #22 WH	Wire #22 UL1007
Z 0	0-00270-052	7-3/4" #22 BLUE	Wire #22 UL1007
Z 0	0-00494-021	6-32X1/2"PP	Screw, Panhead Phillips
Z 0	0-00500-000	554808-1	Hardware, Misc.
Z 0	0-00524-048	8-1/4" #18	Wire, #18 UL1015 Strip 3/8 x 3/8 No Tin
Z 0	0-00541-052	8.5" #22GRN/YEL	Wire #22 UL1007
Z 0	0-00893-026	8-32X3/8PF	Screw, Black, All Types
Z 0	1-00092-171	24 COND	Cable Assembly, Ribbon
Z 0	1-00093-171	24 COND	Cable Assembly, Ribbon
Z 0	1-00094-171	10 PIN SIL	Cable Assembly, Ribbon
Z 0	1-00095-171	10 PIN SIL	Cable Assembly, Ribbon
Z 0	1-00098-112	10 PIN,28AWG/GR	Connector, Amp, MTA-100

Z 0	6-00004-611	1A 3AG	Fuse
Z 0	7-00177-720	SR640-35	Fabricated Part
Z 0	7-00180-720	SR640-40	Fabricated Part
Z 0	7-00182-720	SR640-42	Fabricated Part
Z 0	7-00183-720	SR640-43	Fabricated Part
Z 0	7-00226-720	SR640-46	Fabricated Part
Z 0	7-00237-715	SR640-47	Bracket
Z 0	9-00183-917	SR640 SERIAL	Product Labels
Z 0	9-00267-917	GENERIC	Product Labels

Miscellaneous Parts List

Ref No.	SRS Part No.	Value	Component Description
U 1	3-00345-342	64KX8-120	EPROM/PROM, I.C.
U 6	3-00229-342	27256-200	EPROM/PROM, I.C.
Z 0	0-00150-026	4-40X1/4PF	Screw, Black, All Types
Z 0	0-00167-023	6-32X1/2RP	Screw, Roundhead Phillips
Z 0	0-00179-000	RIGHT FOOT	Hardware, Misc.
Z 0	0-00180-000	LEFT FOOT	Hardware, Misc.
Z 0	0-00185-021	6-32X3/8PP	Screw, Panhead Phillips
Z 0	0-00204-000	REAR FOOT	Hardware, Misc.
Z 0	0-00247-026	6-32X1/4 TRUSSP	Screw, Black, All Types
Z 0	0-00248-026	10-32X3/8TRUSSP	Screw, Black, All Types
Z 0	1-00087-131	2 PIN JUMPER	Connector, Female
Z 0	7-00147-720	BAIL	Fabricated Part
Z 0	7-00178-720	SR640-38	Fabricated Part
Z 0	7-00179-720	SR640-39	Fabricated Part
Z 0	7-00181-720	SR640-41	Fabricated Part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J2
Input A
Input B
GND
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K2A HS-211
K3A HS-212
K3B HS-212
K4A HS-212
K4B HS-212
C1 1U-MF
C2 1U-MF
R1 1M
R2 1M
R3 2.0K
R4 221
U1A LF353
U1B LF353
+15V
-15V
K1B HS-211
K2B HS-211
K3C HS-212
K4C HS-212
A_DESEL
B_DESEL
DC_SEL
ATTEN
C4 10U-E16
R15 6.04K
R16 9.09K
U5A DG211
U5D DG211
U5E DG211
U6
LT1037
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-15V_A
R19 909
R20 100
R21 909
R22 100
RC21 130P
R23 1.37K
R24 432
R25 200
R28 100
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GAIN_2
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GAIN_4
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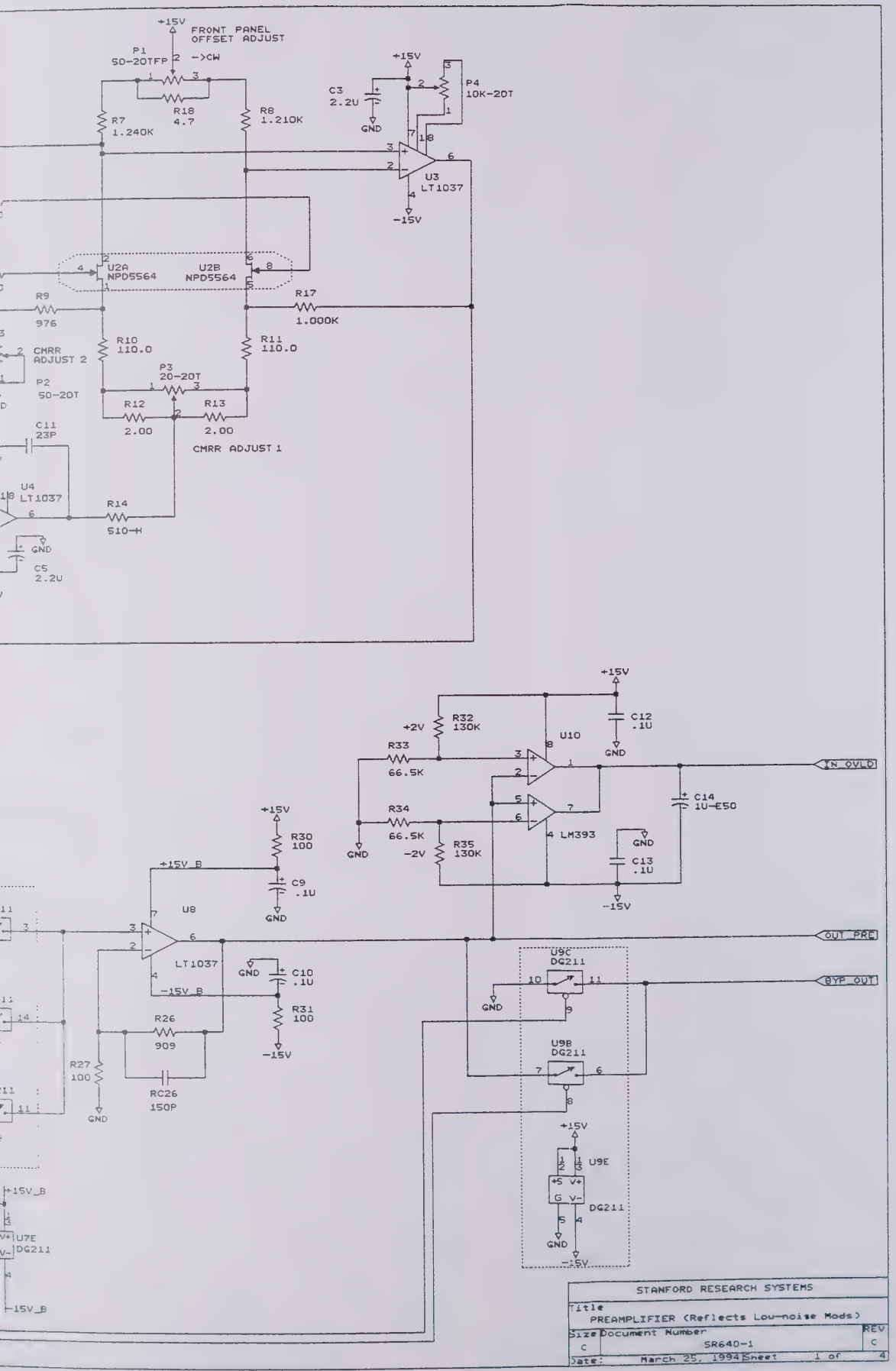
-BYPASS



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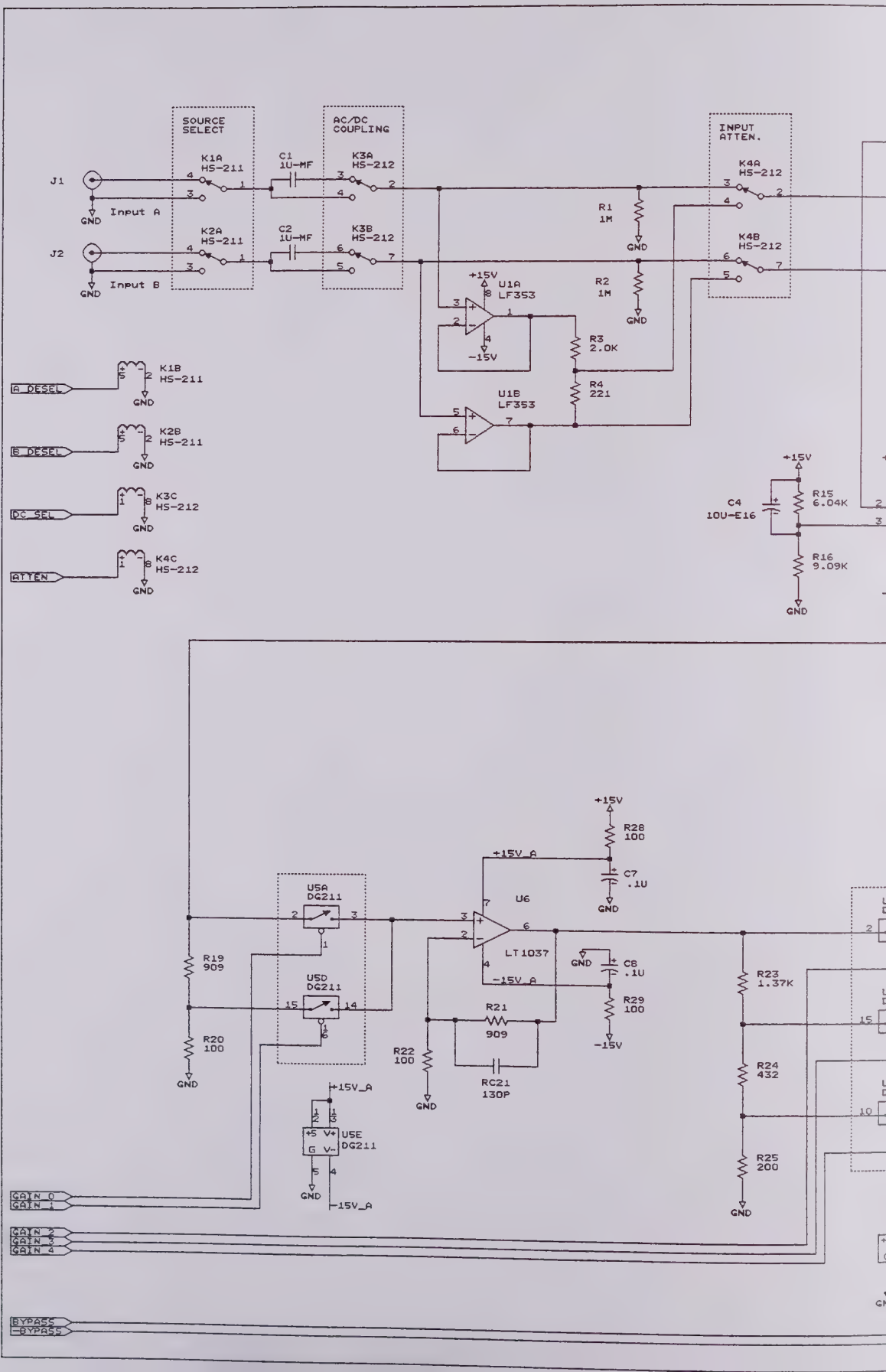
Date: March 25, 1994	Sheet 1 of 4	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AC/DC COUPLING
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J1
J2
Input A
Input B
GND
K1A HS-211
K2A HS-211
K3A HS-212
K3B HS-212
K4A HS-212
K4B HS-212
C1 1U-MF
C2 1U-MF
R1 1M
R2 1M
R3 2.0K
R4 221
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-15V
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K3C HS-212
K4C HS-212
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B_DESEL
DC_SEL
ATTEN
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R16 9.09K
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U5D DG211
U5E DG211
U6 LT1037
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-15V_A
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R20 100
R21 909
R22 100
RC21 130P
R23 1.37K
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R25 200
R28 100
R29 100
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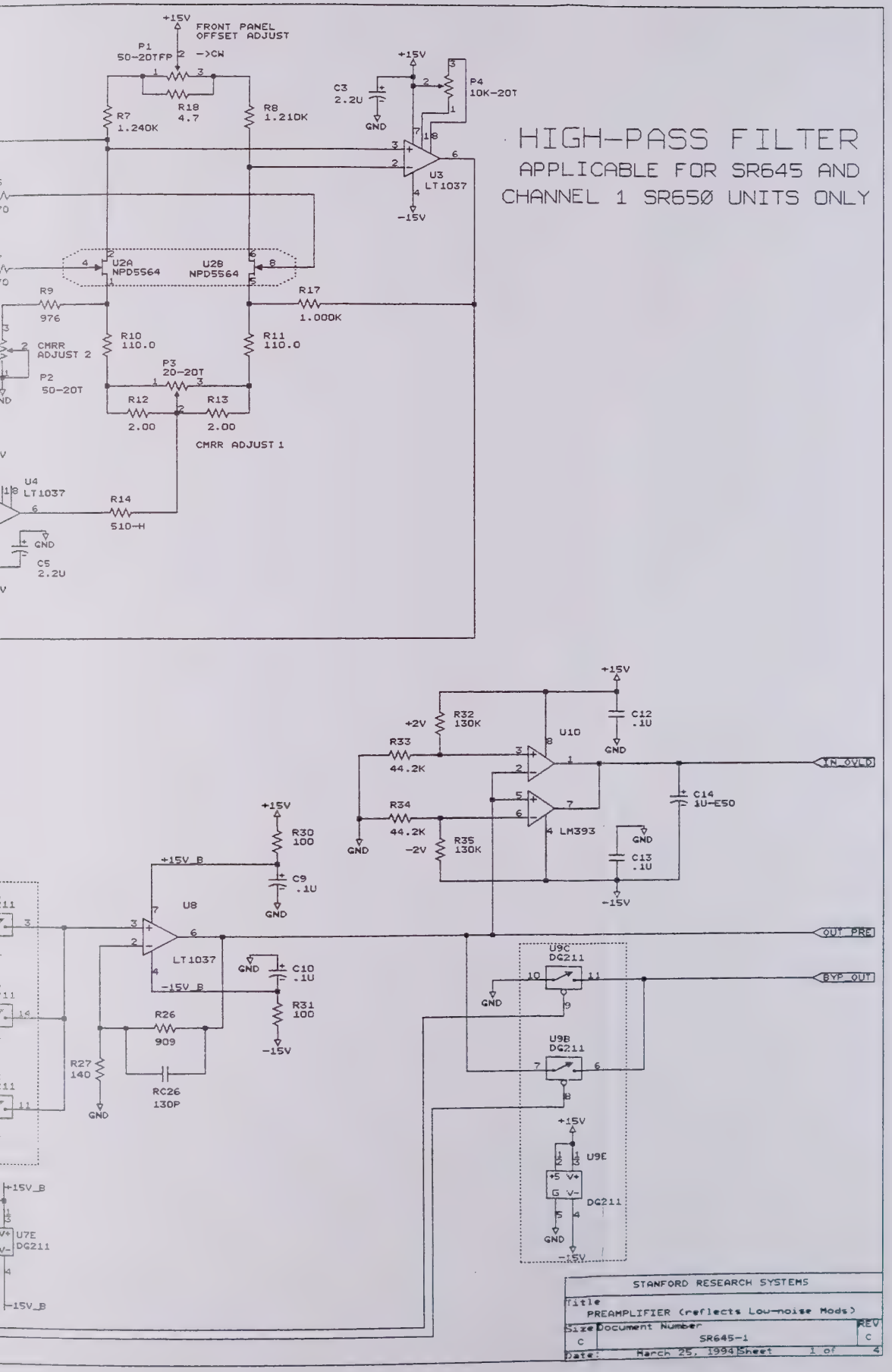
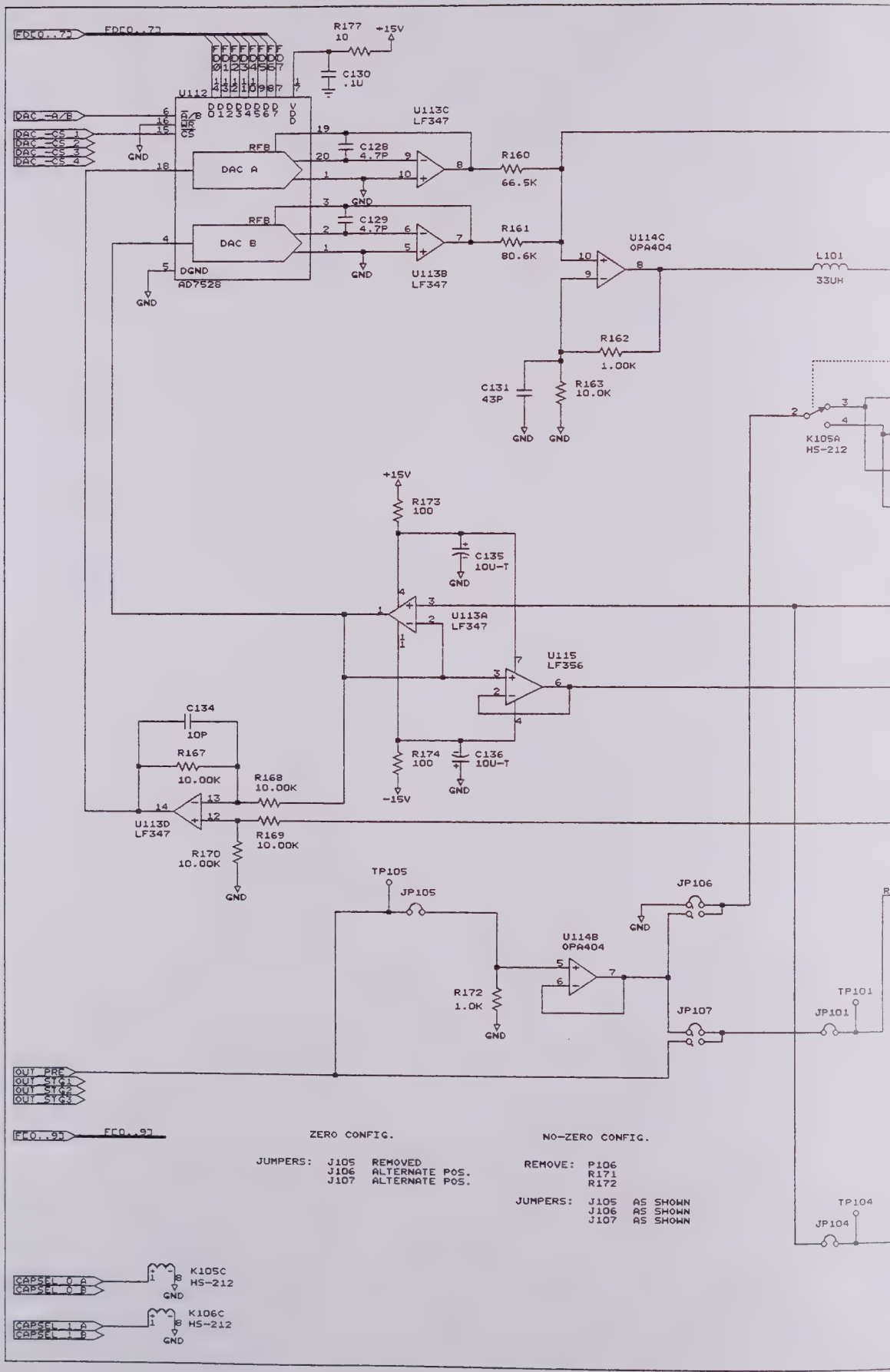
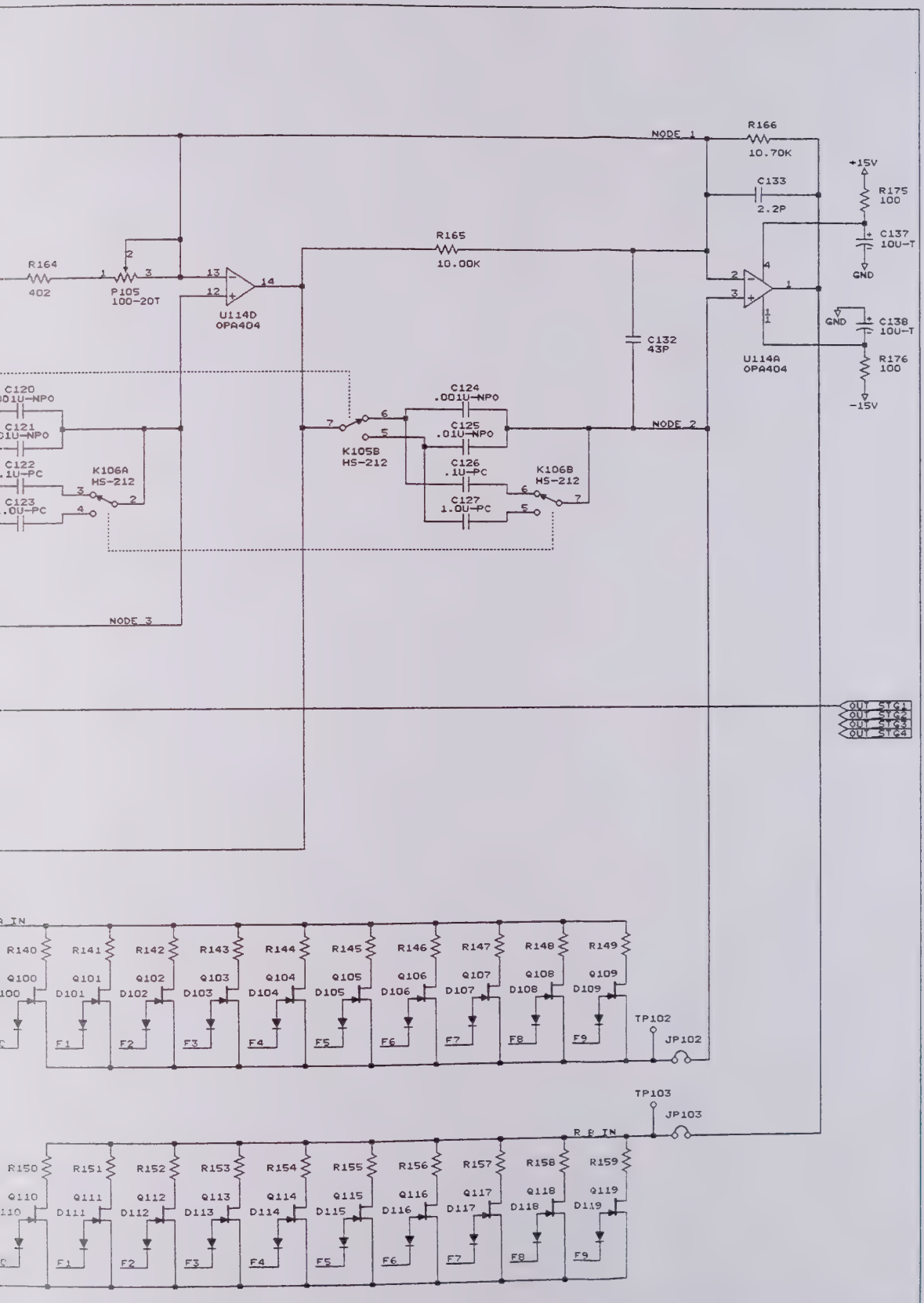
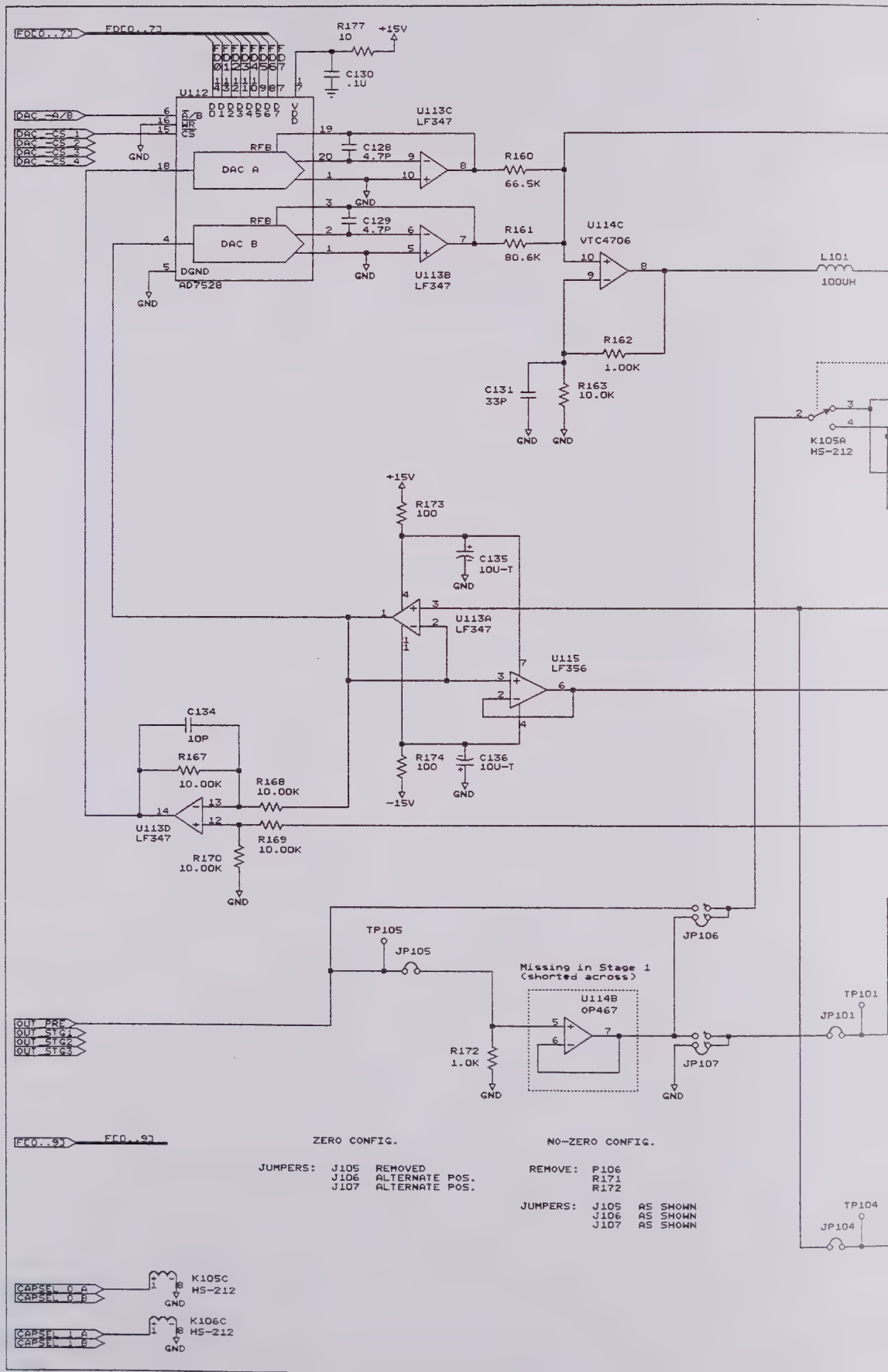
C8 .1U
GAIN 0
GAIN 1
GAIN 2
GAIN 3
GAIN 4
BYPASS
-BYPASS


HIGH-PASS FILTER
APPLICABLE FOR SR645 AND
CHANNEL 1 SR650 UNITS ONLY
+15V
FRONT PANEL
OFFSET ADJUST
P1
50-20TFP
->CW
R18
4.7
R7
1.240K
R8
1.210K
C3
2.2U
GND
P4
10K-20T
U3
LT1037
-15V
U2A
NPD5564
U2B
NPD5564
R9
976
R17
1.000K
R10
110.0
R11
110.0
CMRR
ADJUST 2
P2
50-20T
P3
20-20T
R12
2.00
R13
2.00
CMRR ADJUST 1
U4
LT1037
R14
510-H
C5
2.2U
+2V
R32
130K
R33
44.2K
U10
C12
.1U
IN_OVLD
R34
44.2K
R35
130K
-2V
LM393
C14
1U-E50
C13
.1U
+15V_B
R30
100
C9
.1U
U8
LT1037
OUT_PRE
C10
.1U
-15V_B
R31
100
U9C
DG211
BYP_OUT
R26
909
R27
140
RC26
130P
U9B
DG211
U9E
DG211
U7E
DG211
STANFORD RESEARCH SYSTEMS
Title
PREAMPLIFIER (reflects Low-noise Mods)
Size
C
Document Number
SR645-1
REV
C
Date:
March 25, 1994
Sheet
1 of
4


FDC0..7J
FDC0..7J
R177
10
+15V
C130
.1U
U112
DAC_A/B
DAC_CS1
DAC_CS2
DAC_CS3
DAC_CS4
GND
DAC A
DAC B
RFB
DGND
AD7528
U113C
LF347
C128
4.7P
C129
4.7P
R160
66.5K
R161
80.6K
U113B
LF347
U114C
OPA404
L101
33UH
R162
1.00K
C131
43P
R163
10.0K
K105A
HS-212
+15V
R173
100
C135
10U-T
U113A
LF347
U115
LF356
C134
10P
R167
10.00K
R168
10.00K
R174
100
C136
10U-T
-15V
U113D
LF347
R169
10.00K
R170
10.00K
TP105
JP105
JP106
U114B
OPA404
R172
1.0K
JP107
TP101
JP101
OUT_PRE
OUT_STG1
OUT_STG2
OUT_STG3
FC0..9J
FC0..9J
ZERO CONFIG.
JUMPERS: J105 REMOVED
J106 ALTERNATE POS.
J107 ALTERNATE POS.
NO-ZERO CONFIG.
REMOVE: P106
R171
R172
JUMPERS: J105 AS SHOWN
J106 AS SHOWN
J107 AS SHOWN
TP104
JP104
CAPSEL_0_A
CAPSEL_0_B
K105C
HS-212
CAPSEL_1_A
CAPSEL_1_B
K106C
HS-212

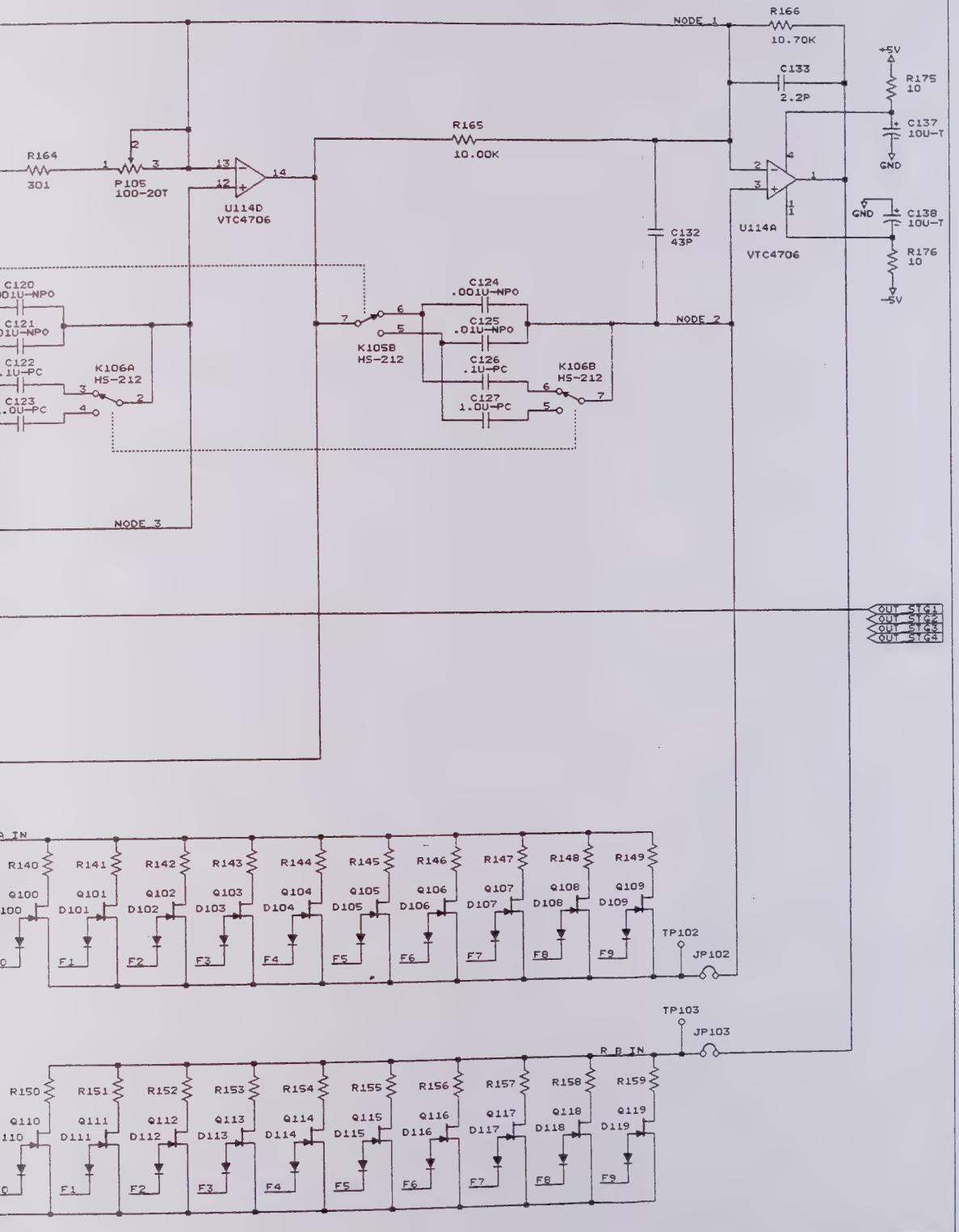


STANFORD RESEARCH SYSTEMS		
Title: LP FILTER STAGE		
Size: C	Document Number: SR640-2	REV: C
Date: March 25, 1994	Sheet 2 of 4	

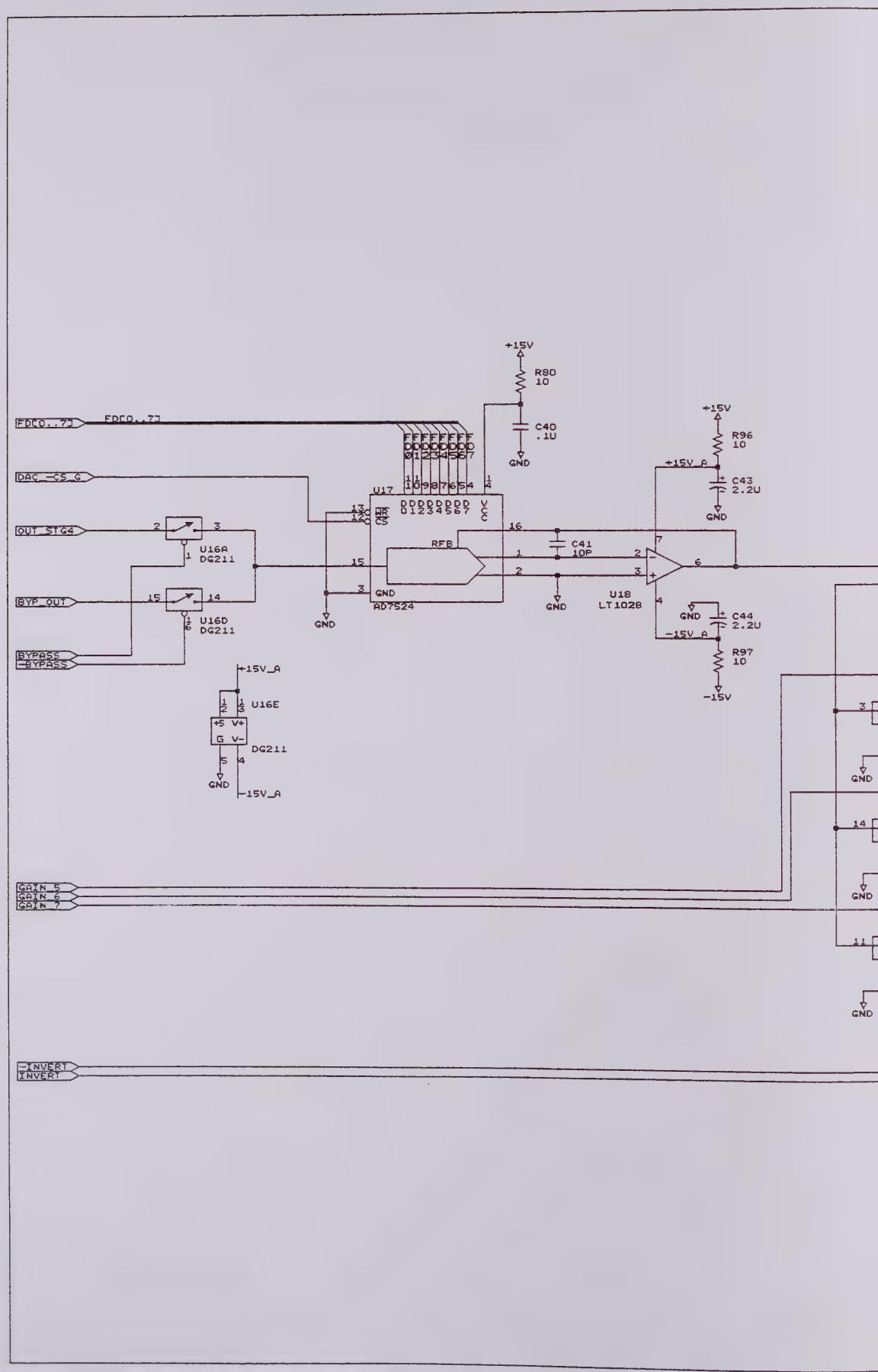

FDI0..7J
FDF0..7J
R177
10
+15V
C130
.1U
U112
DAC -A/B
DAC -CS 1
DAC -CS 2
DAC -CS 3
DAC -CS 4
GND
DAC A
DAC B
DGND
AD7528
U113C
LF347
RFB
C128
4.7P
R160
66.5K
C129
4.7P
R161
80.6K
U113B
LF347
U114C
VTC4706
L101
100UH
R162
1.00K
C131
33P
R163
10.0K
K105A
HS-2I2
+15V
R173
100
C135
10U-T
U113A
LF347
U115
LF356
C134
10P
R167
10.00K
R168
10.00K
U113D
LF347
R169
10.00K
R170
10.00K
R174
100
C136
10U-T
-15V
TP105
JP105
JP106
Missing in Stage 1
(shorted across)
U114B
OP467
R172
1.0K
JP107
TP101
JP101
TP104
JP104
OUT_PRE
OUT_STG1
OUT_STG2
OUT_STG3
FEI0..9J
FEF0..9J
ZERO CONFIG.
JUMPERS: J105 REMOVED
J106 ALTERNATE POS.
J107 ALTERNATE POS.
NO-ZERO CONFIG.
REMOVE: P106
R171
R172
JUMPERS: J105 AS SHOWN
J106 AS SHOWN
J107 AS SHOWN
CAPSEL_0_A
CAPSEL_0_B
K105C
HS-212
CAPSEL_1_A
CAPSEL_1_B
K106C
HS-212

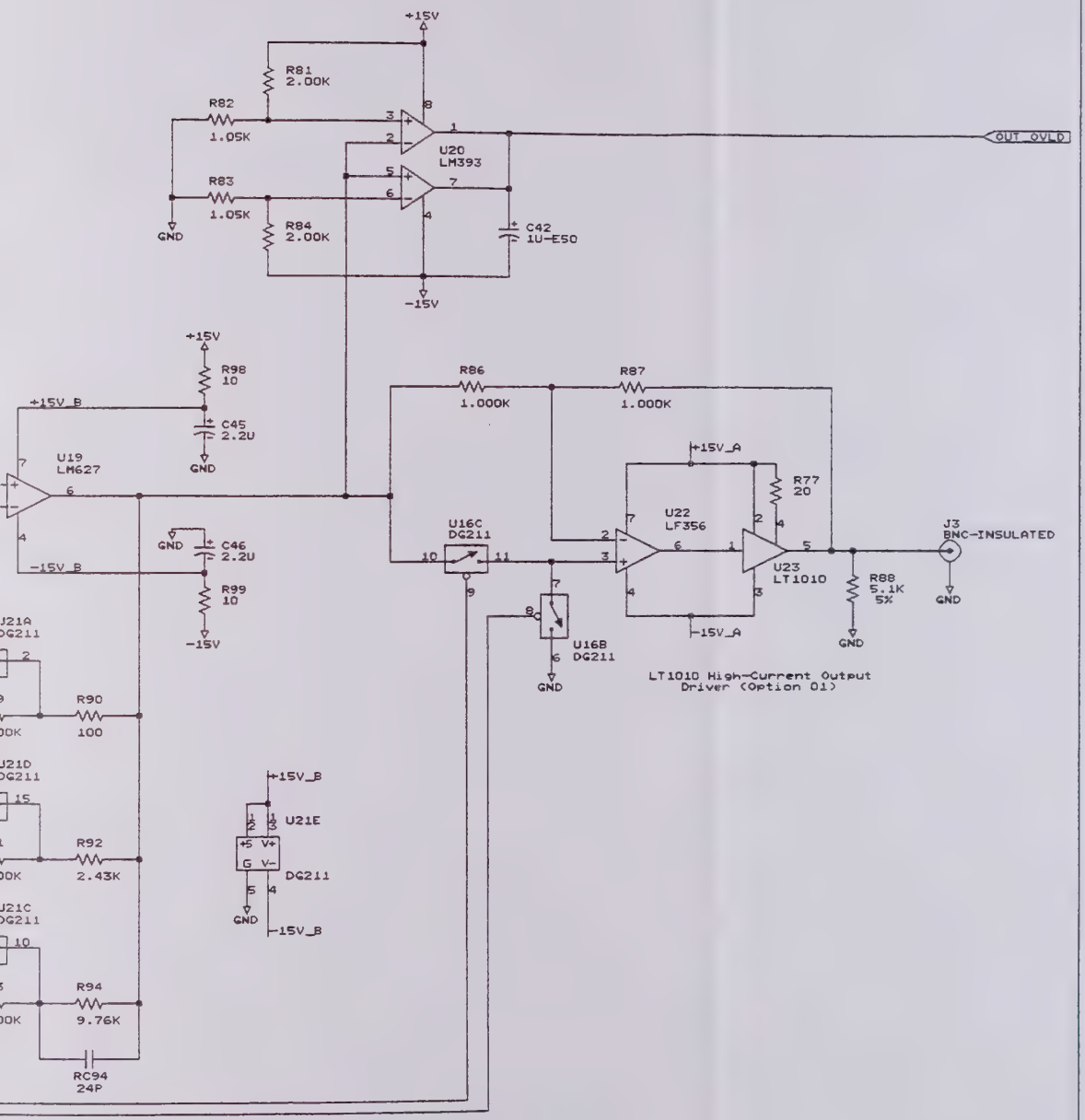
HIGH-PASS FILTER

APPLICABLE FOR SR645 AND CHANNEL 1 SR650 UNITS ONLY

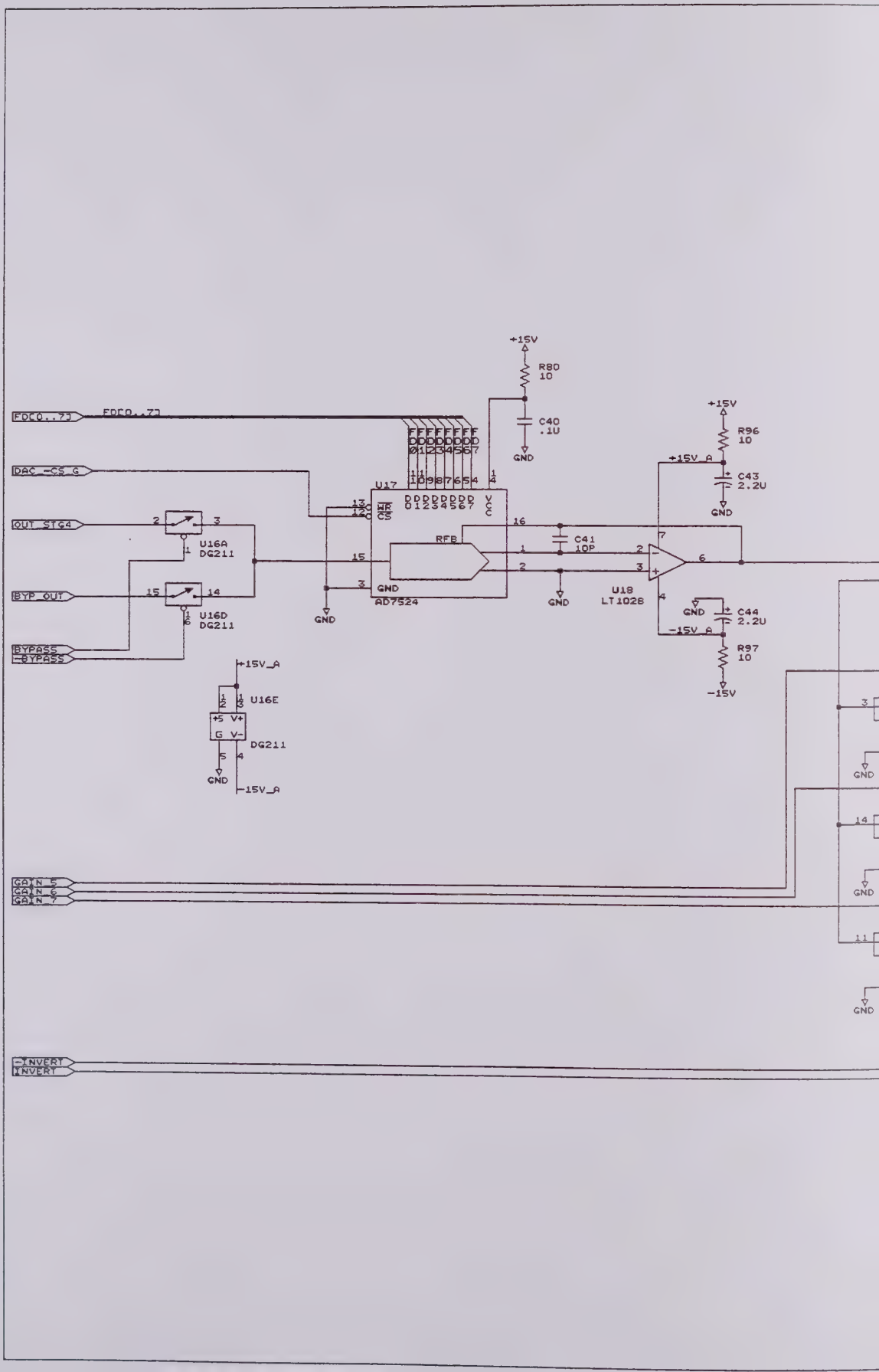


STANFORD RESEARCH SYSTEMS		
Title: HP FILTER STAGE		
Size: C	Document Number: SR645-2	REV: A
Date: March 25, 1994	Sheet: 2 of 4	


+15V
R80
10
C40
.1U
GND
FDC0..7J
FDC0..7J
DAC_~CS_G
OUT_STG4
BYP_OUT
BYPASS
~BYPASS
U17
AD7524
RFB
U16A
DG211
U16D
DG211
U16E
DG211
+15V_A
-15V_A
C41
10P
U18
LT1028
R96
10
C43
2.2U
C44
2.2U
R97
10
-15V
GAIN_5
GAIN_6
GAIN_7
~INVERT
INVERT

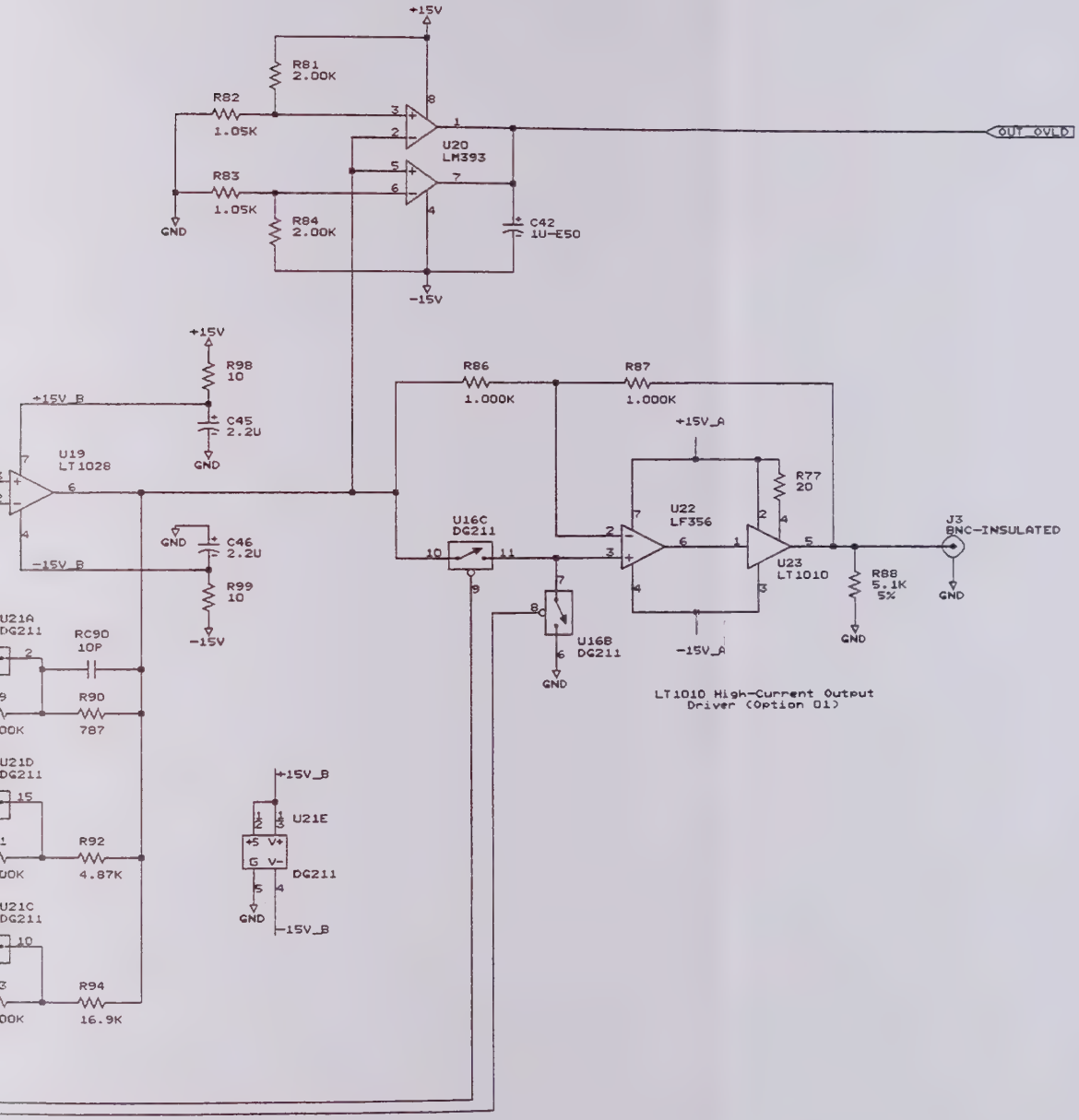


STANFORD RESEARCH SYSTEMS		
Title: OUTPUT AMPLIFIER (Reflects Low-noise Mods)		
Size: C	Document Number: SR640-3	REV: C
Date: March 9, 1994	Sheet: 3 of 4	

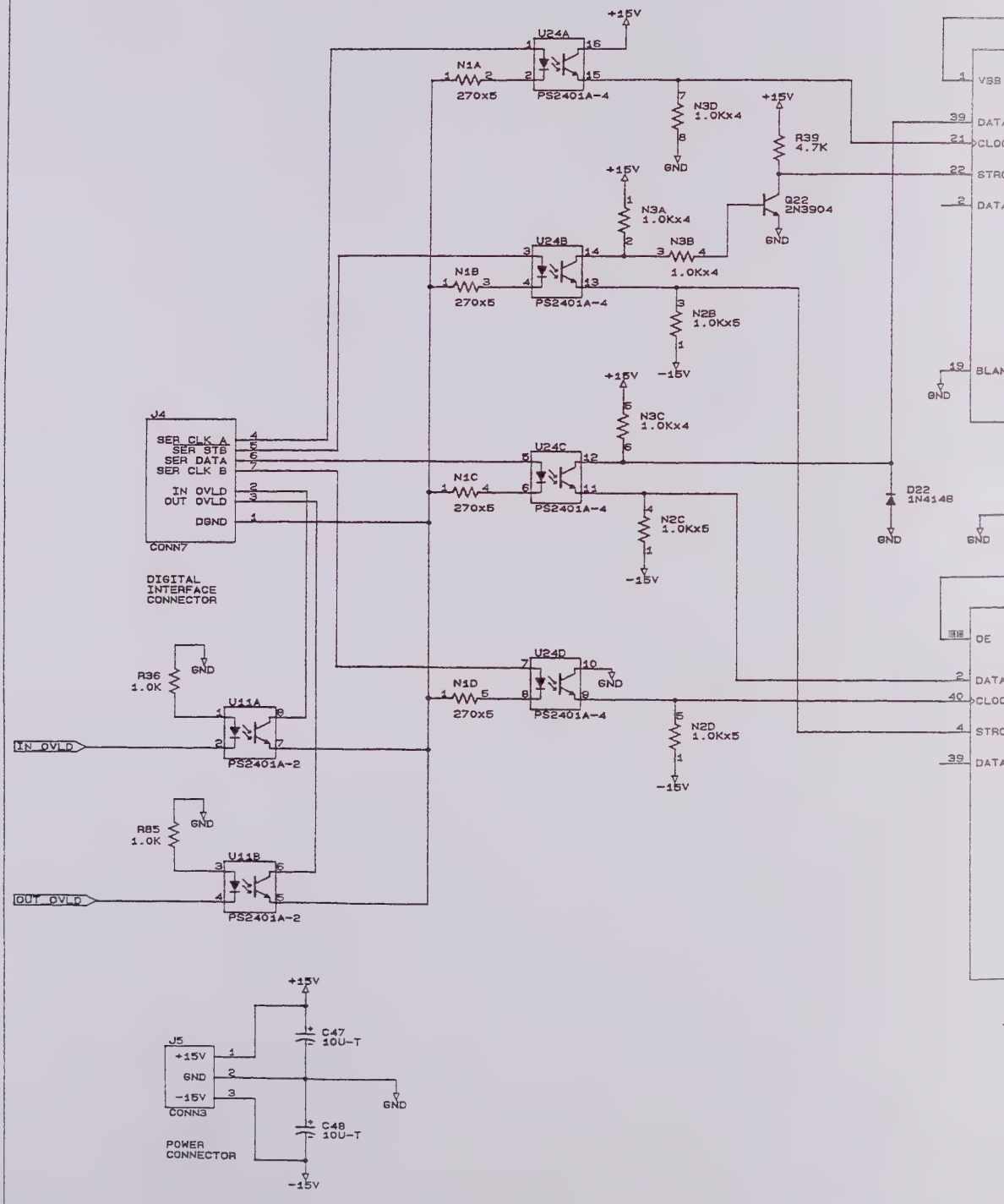

+15V
R80
10
C40
.1U
GND
FDD[0..7]
DAC_-CS_G
OUT_STG4
BYP_OUT
BYPASS
-BYPASS
U16A
DG211
U16D
DG211
U17
AD7524
RFB
GND
C41
10P
U18
LT1028
+15V
R96
10
+15V_A
C43
2.2U
-15V_A
C44
2.2U
R97
10
-15V
U16E
DG211
+15V_A
-15V_A
GAIN_5
GAIN_6
GAIN_7
-INVERT
INVERT

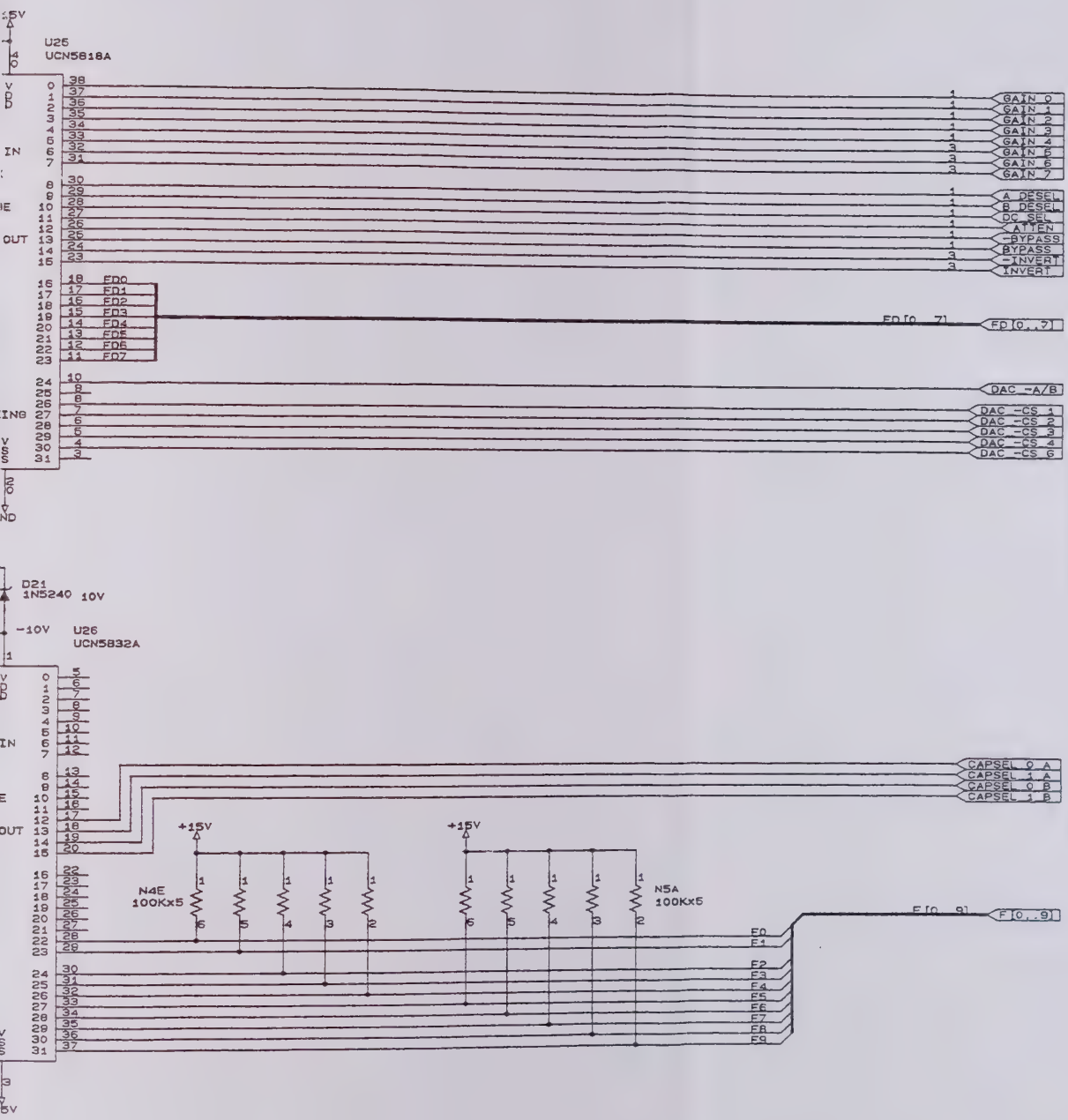
HIGH-PASS FILTER

APPLICABLE FOR SR645 AND CHANNEL 1 SR650 UNITS ONLY

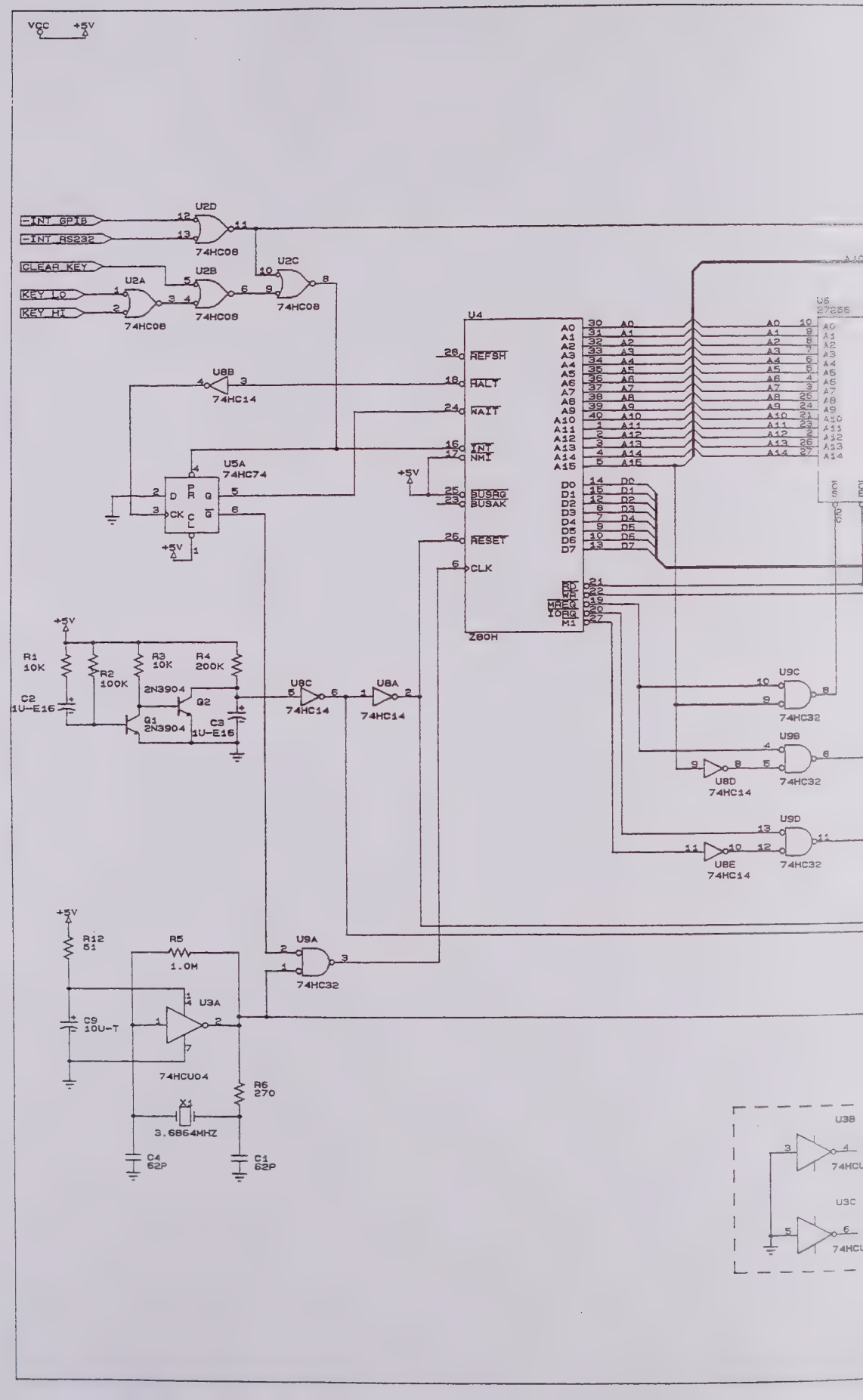


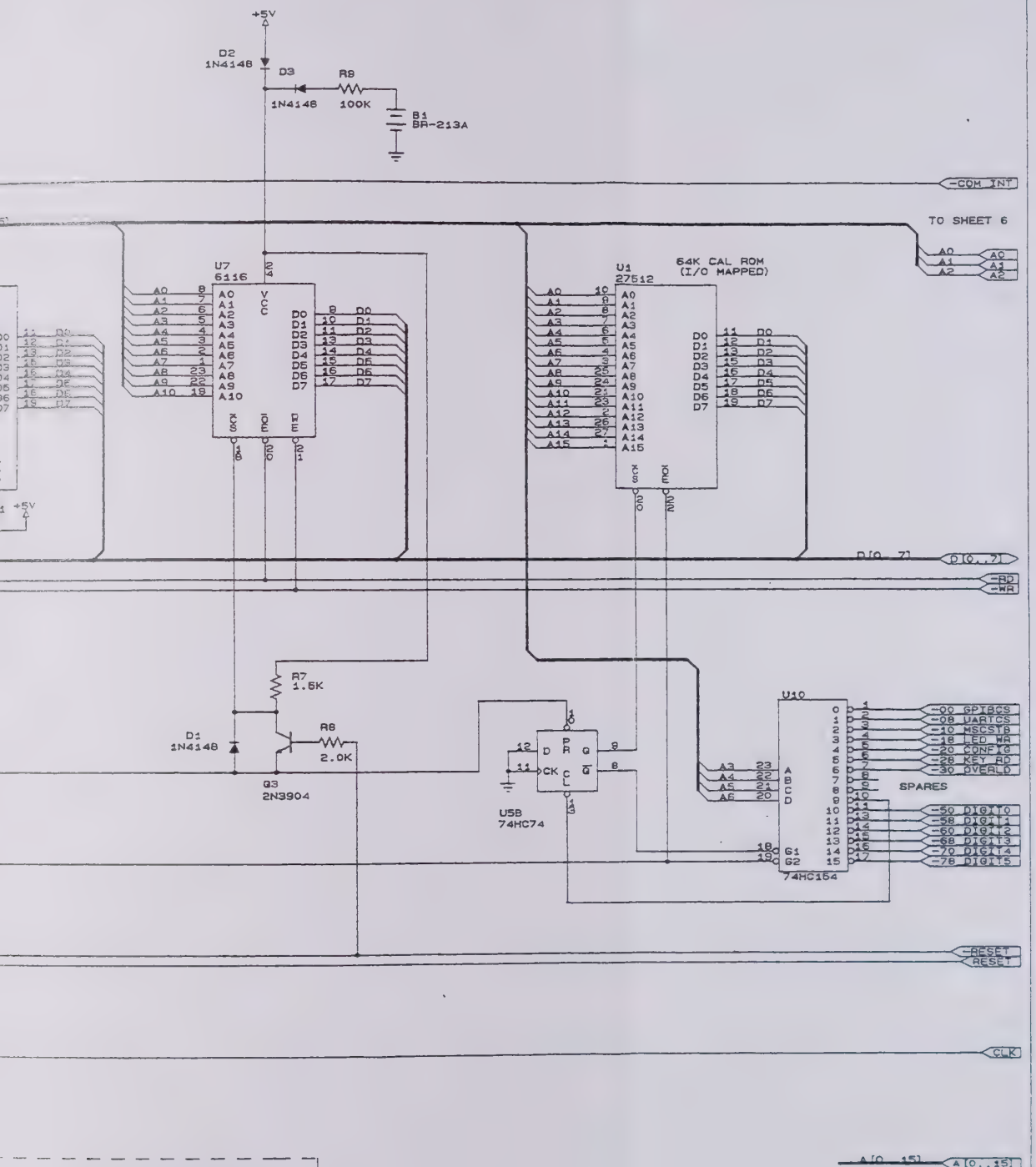
STANFORD RESEARCH SYSTEMS		
Title: OUTPUT AMPLIFIER (reflects Low-noise Mods)		
Size: C	Document Number: SR645-3	REV: A
Date: March 25, 1994	Sheet 3 of 4	

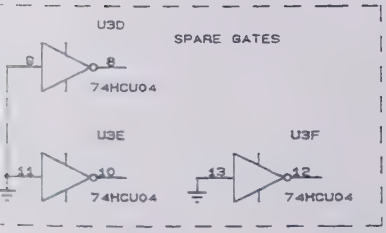

+15V
U24A
N1A
270x5
PS2401A-4
N3D
1.0Kx4
GND
R39
4.7K
Q22
2N3904
N3A
1.0Kx4
U24B
N3B
1.0Kx4
N1B
270x5
PS2401A-4
N2B
1.0Kx5
-15V
N3C
1.0Kx4
U24C
N1C
270x5
PS2401A-4
N2C
1.0Kx5
D22
1N4148
J4
SER CLK A
SER STB
SER DATA
SER CLK B
IN OVLD
OUT OVLD
DGND
CONN7
DIGITAL
INTERFACE
CONNECTOR
R36
1.0K
U11A
PS2401A-2
IN_OVLD
R85
1.0K
U11B
PS2401A-2
OUT_OVLD
U24D
N1D
270x5
PS2401A-4
N2D
1.0Kx5
J5
+15V
GND
-15V
CONN3
POWER
CONNECTOR
C47
10U-T
C48
10U-T
VSS
DATA
CLOCK
STROBE
BLANK
OE



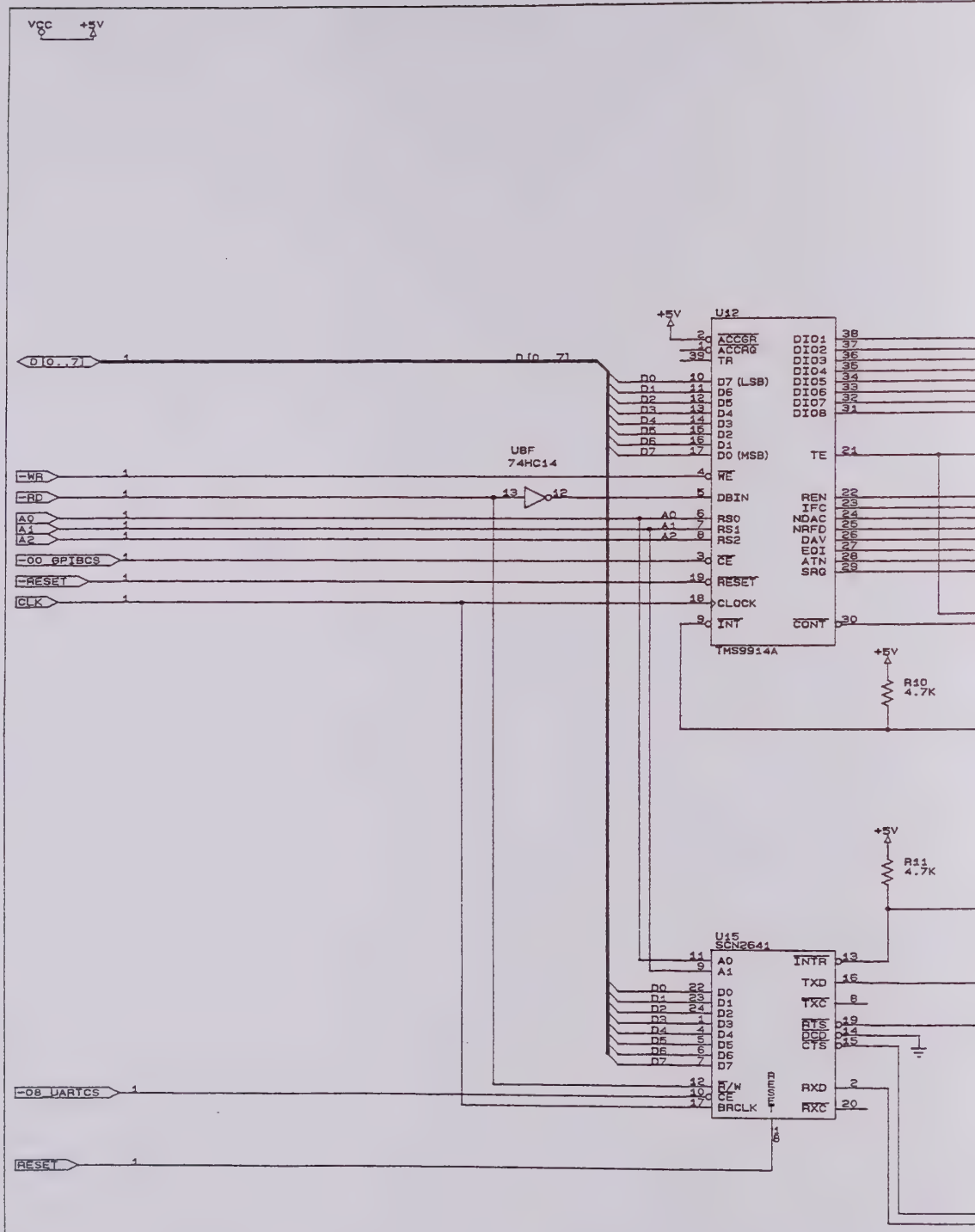
STANFORD RESEARCH SYSTEMS		
Title: OPTOISOLATED INTERFACE		
Size: C	Document Number: SR640-4	REV: C
Date: October 26, 1988	Sheet 4 of 4	

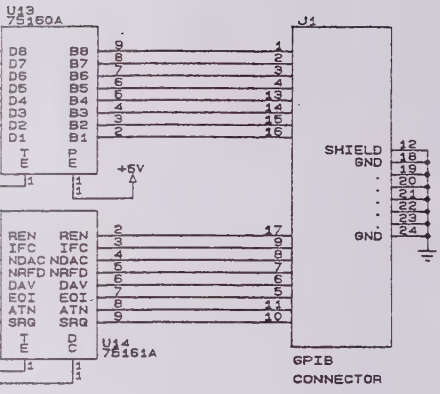

VCC +5V
-INT GPIB
-INT RS232
CLEAR KEY
KEY LO
KEY HI
U2D
U2C
U2B
U2A
74HC08
U8B
74HC14
U5A
74HC74
U4
REFSH
HALT
WAIT
INT
NMI
BUSRQ
BUSAK
RESET
CLK
Z80H
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15
D0 D1 D2 D3 D4 D5 D6 D7
MREQ IORQ M1
R1 10K
R2 100K
R3 10K
R4 200K
2N3904
Q1
Q2
C2 1U-E16
C3 1U-E16
U8C
U8A
U9C
U9B
U8D
U9D
U8E
74HC32
R12 51
R5 1.0M
U9A
U3A
74HCU04
C9 10U-T
R6 270
X1
3.6864MHZ
C4 62P
C1 62P
U3B
U3C





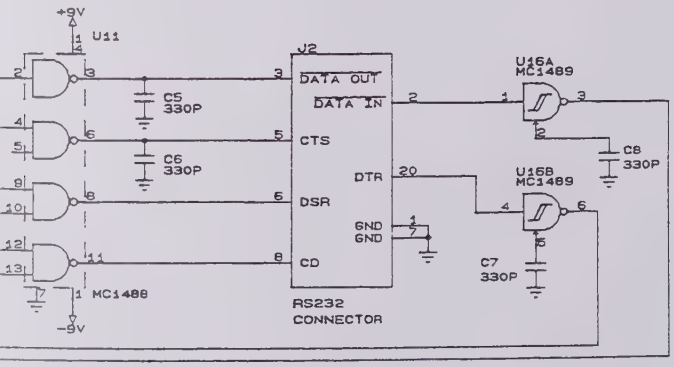
STANFORD RESEARCH SYSTEMS		
Title: MICROPROCESSOR		
Size: C	Document Number: SR640-5	REV: C
Date: January 26, 1989	Sheet 1 of 4	


VCC +5V
U12
TMS9914A
ACCGR
ACCRQ
TR
D7 (LSB)
D6
D5
D4
D3
D2
D1
D0 (MSB)
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
TE
WE
DBIN
REN
IFC
NDAC
NRFD
DAV
EOI
ATN
SRQ
RS0
RS1
RS2
CE
RESET
CLOCK
INT
CONT
D[0..7]
UBF
74HC14
-WR
-RD
A0
A1
A2
-00_GPIBCS
-RESET
CLK
R10
4.7K
R11
4.7K
U15
SCN2641
INTR
TXD
TXC
RTS
DCD
CTS
RXD
RXC
R/W
CE
BRCLK
-08_UARTCS
RESET

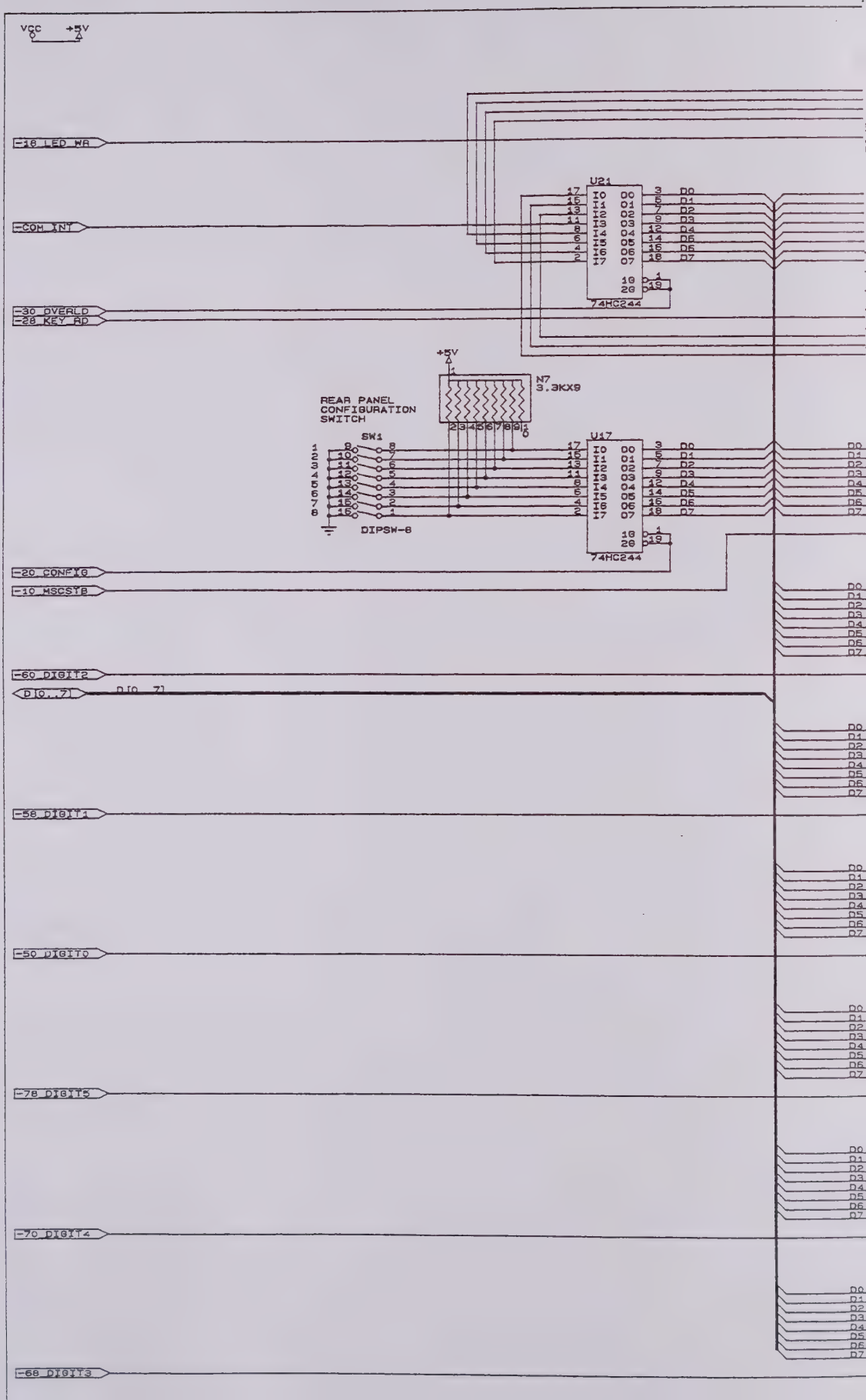


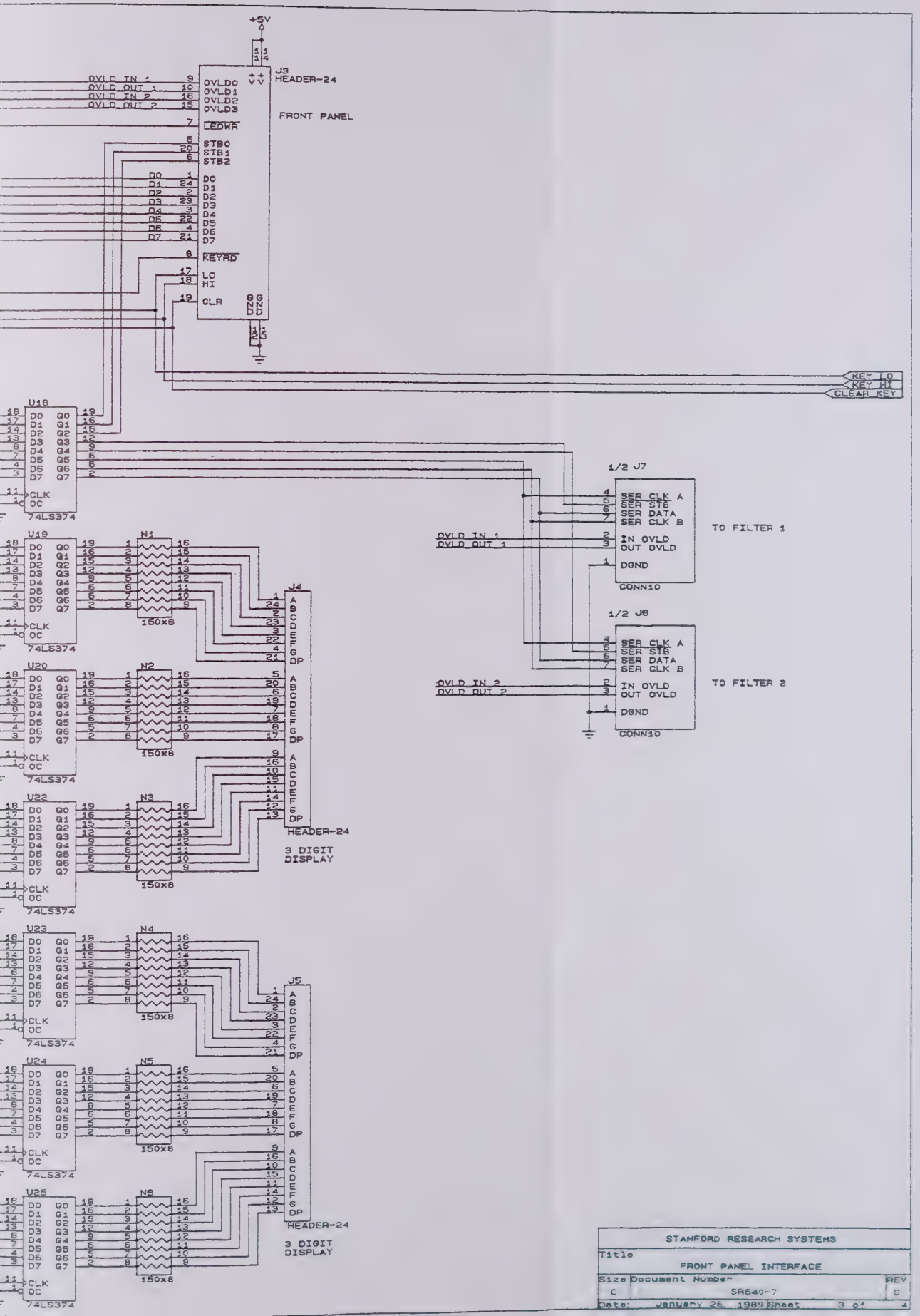
-INT_GPIB

-INT_RS232

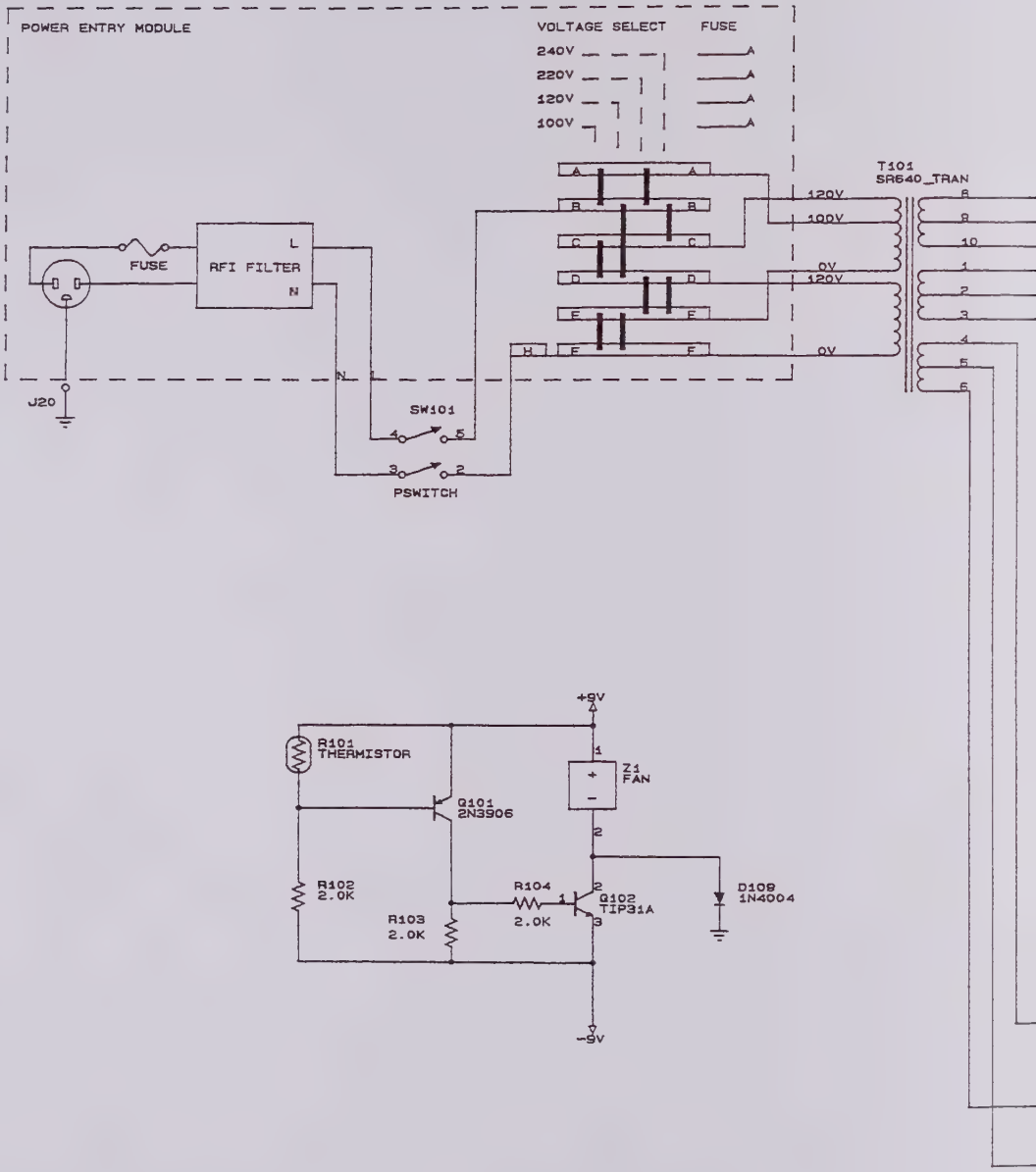


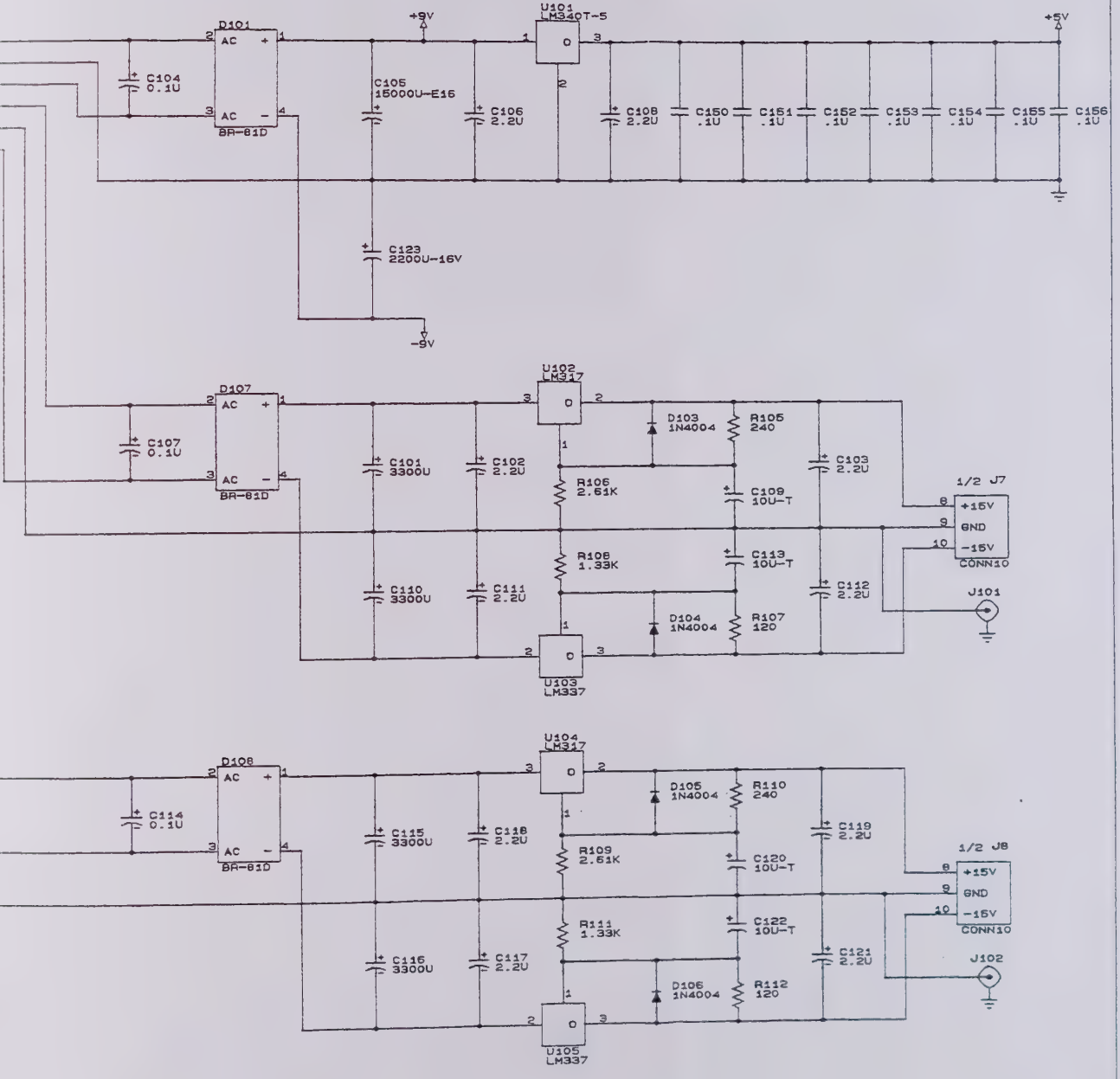
STANFORD RESEARCH SYSTEMS		
Title: COMMUNICATIONS		
Size: C	Document Number: SR640-6	REV: C
Date: January 26, 1989	Sheet 2 of 4	


VCC +5V
-10 LED WR
-COM INT
-30 OVERLD
-28 KEY RD
U21
74HC244
+5V
N7
3.3KX9
REAR PANEL
CONFIGURATION
SWITCH
SW1
DIPSW-8
U17
74HC244
-20 CONFIG
-10 MSCSTB
-60 DIGIT2
D[0..7]
-58 DIGIT1
-50 DIGIT0
-78 DIGIT5
-70 DIGIT4
-68 DIGIT3

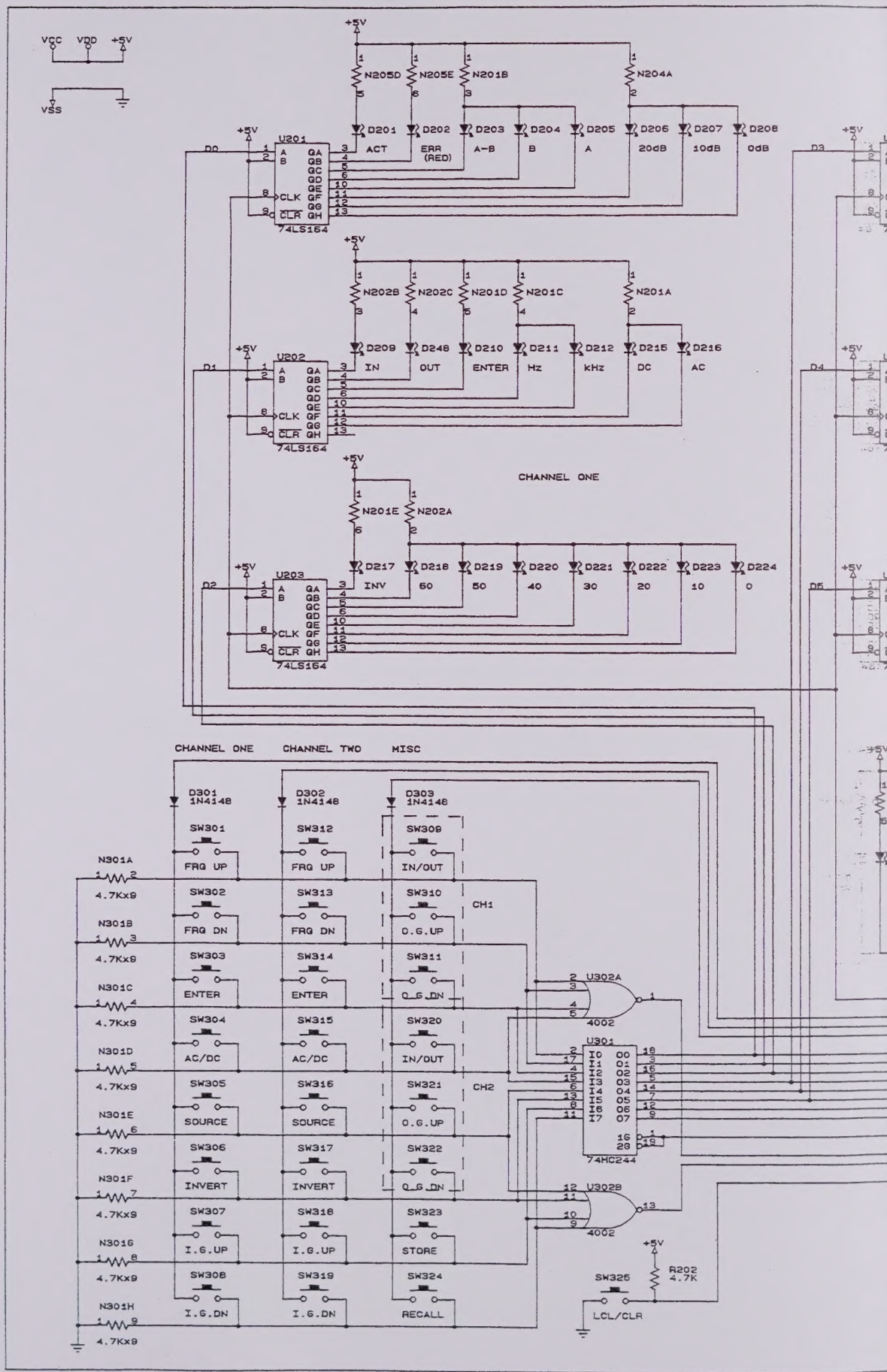


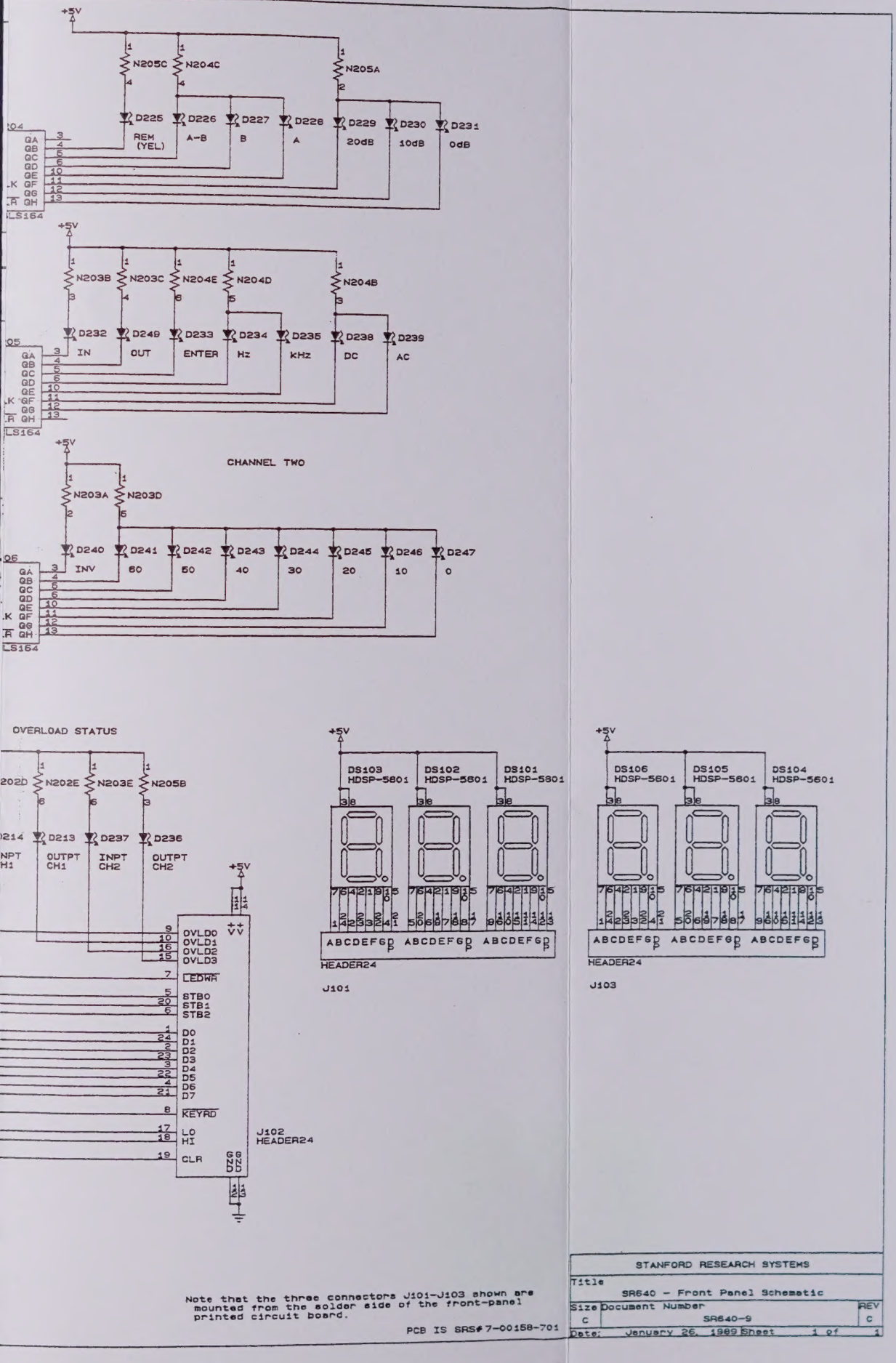
STANFORD RESEARCH SYSTEMS		
Title: FRONT PANEL INTERFACE		
Size: C	Document Number: SR640-7	REV: C
Date: January 26, 1989	Sheet: 3 of 4	


POWER ENTRY MODULE
VOLTAGE SELECT
FUSE
240V
220V
120V
100V
A
A
A
A
T101
SR640_TRAN
120V
100V
0V
120V
0V
FUSE
RFI FILTER
L
N
J20
SW101
PSWITCH
R101
THERMISTOR
Q101
2N3906
Z1
FAN
+9V
-9V
R102
2.0K
R103
2.0K
R104
2.0K
Q102
TIP31A
D109
1N4004



STANFORD RESEARCH SYSTEMS		
Title: POWER SUPPLIES		
Size: C	Document Number: SR640-8	REV: C
Date: January 26, 1989	Sheet: 4 of 4	


VCC VDD +5V
VSS
+5V
N205D N205E N201B N204A
D201 ACT
D202 ERR (RED)
D203 A-B
D204 B
D205 A
D206 20dB
D207 10dB
D208 0dB
U201
74LS164
D0
N202B N202C N201D N201C N201A
D209 IN
D248 OUT
D210 ENTER
D211 Hz
D212 kHz
D215 DC
D216 AC
U202
D1
CHANNEL ONE
N201E N202A
D217 INV
D218 60
D219 50
D220 40
D221 30
D222 20
D223 10
D224 0
U203
D2
D3
D4
D5
CHANNEL ONE
CHANNEL TWO
MISC
D301 1N4148
D302 1N4148
D303 1N4148
SW301 FRQ UP
SW312 FRQ UP
SW309 IN/OUT
SW302 FRQ DN
SW313 FRQ DN
SW310 O.G.UP
SW303 ENTER
SW314 ENTER
SW311 O_G_DN
SW304 AC/DC
SW315 AC/DC
SW320 IN/OUT
SW305 SOURCE
SW316 SOURCE
SW321 O.G.UP
SW306 INVERT
SW317 INVERT
SW322 O_G_DN
SW307 I.G.UP
SW318 I.G.UP
SW323 STORE
SW308 I.G.DN
SW319 I.G.DN
SW324 RECALL
CH1
CH2
N301A 4.7Kx9
N301B 4.7Kx9
N301C 4.7Kx9
N301D 4.7Kx9
N301E 4.7Kx9
N301F 4.7Kx9
N301G 4.7Kx9
N301H 4.7Kx9
U302A
4002
U302B
4002
U301
74HC244
SW325 LCL/CLR
R202 4.7K



Note that the three connectors J101-J103 shown are mounted from the solder side of the front-panel printed circuit board.

PCB IS SRS# 7-00158-701

STANFORD RESEARCH SYSTEMS		
Title: SR640 — Front Panel Schematic		
Size: C	Document Number: SR640-9	REV: C
Date: January 26, 1989	Sheet 1 of 1	

MP MASTER
MA28851